How I Made $350.00 On One Short Story

And How I Learned to Write, In Only a Few Evenings, Stories That Actually Sell Themselves

EVEN as a child I wanted to write stories. Often when vague ideas suggested themselves to me, I longed for the means of expression—I longed to put down on paper, in glowing words and phrases, the thoughts that surged up within me. Often I felt the strong desire to write about my hopes, my disappointments, my joys, my sorrows—so that all the world would read and understand.

I Found Myself in the Office of One of the City's "Big Business" Men.

But youth has a way of slipping mysteriously by, and before I realized it, I found myself in the office of one of the city's "Big Business" men — as his secretary. Gone were the dreams of brilliant authorship. Gone were the dreams of fame and fortune. As so many other budding young writers before me, I had swerved from the path of glory through the lack of proper training.

Yet, often, as I watched the teeming life about me, I felt that same irresistible urge that I had felt in childhood—the impulse to write my impressions of this world and its people. I wanted to weave into fascinating stories my little daily experiences and the characters who played a part in them.

Are Writers Born or Made?

And so I tried to write—poems at first, then articles, then stories. But somehow I did not *seem able to put down* in words the thoughts and emotions that ran in rapid confusion through my mind.

What did I lack? Why couldn't *I* write stories in that subtle, interest-arousing way that kept one absorbed to the very end? Why couldn't *I* write the kind of stories that editors paid high prices for, and people read eagerly?

One day I was glancing through a magazine. I began to picture my name in big, black letters at the top of the page. I began to picture my story printed for thousands of people to read. It sent an inexpressible thrill through me, and looking up suddenly, I said to Dad, "Do you know, I think I *can* write stories."

"You! Why, my dear, you have to be *born* to be a writer."

I glanced back at the magazine in my lap. The table of contents included the names of as many women as men. Were they, then, all geniuses? Were they all "born to write?" I read some of the stories and was frankly puzzled. Here were plot-ideas so simple a child could invent them—and yet they held the interest to the very end.

Often ideas had occurred to me for stories—ideas certainly more interesting and striking than these—but I could not build up the story step by step as these authors had done. If I could find the right words and expressions, the sympathetic touch of human nature, the correct technique—

Technique. That was what I needed. I didn't know how to begin my story. I didn't know how to introduce my characters. I didn't know how to create interesting complications and weave around the main characters tense emotional effects.

Were writers really born after all? I began to wonder—and hope.

I Do a Bit of Investigating

It seemed suddenly that all my long pent-up ambitions gave vent to an overwhelming enthusiasm. I started to read books on short story writing. I started to study the technique of plot-building, the laws of short story writing. I read all about authors, and made a thorough investigation of the different methods used by the teachers of short story writing.

I was just the least bit disappointed at first. Despite all my study, the stories I wrote failed somehow to hit the mark. After a few rejection slips I began to feel rather discouraged.

Then, one day, I came across an interesting article about Prof. Walter B. Pitkin. I found out that practically one-third of all the big writers in this country actually had studied his method, which he has been following with extraordinary success for over ten years. I found out that his method of teaching short story writing is used in more than two hundred of the greatest universities and colleges in America. I found out that some of our most popular authors go to him for help and advice in working out the plots of their stories.

A Newspaper Heard of Me and Sent Me to California.

The articles filled me with new hope. It told all about the wonderful success young writers had made, not only in the short story field, but as novelists, playwrights, editors, and writers. If these people could *learn* to write, I could too, I told myself firmly. Dad was wrong. Writers were made, not born.

I Sell My First Story

Of course, I could not give up my position and go to Columbia University where Prof. Pitkin teaches Journalism—but I could study his wonderful methods at home in my spare time. I sent for his course "How to Write Stories" and it has proved the most important step I ever made.

Prof. Pitkin's course revealed to me the secret of creating interest. It taught me how to give my story that subtle touch that appeals to the editor. It taught me how to hold the readers spell-bound. Best of all, it taught me how to find ideas for stories in the most trivial happenings.

And so I studied Prof. Pitkin's course in my spare time, and while I studied it I wrote a story based on one of its plot suggestions. I sent it to one of the biggest magazines in the country, confident that the technique was faultless, that I had woven setting, plot and characters into an absorbing narrative.

With the passing of a few days I received a check for $350.00—a check that meant the beginning of a new life for me, a foothold on the ladder to fortune and fame.

I Now Write "Movie" Stories for Big Pay

That was the beginning. After that I found it was very easy for me to write an interesting little tale in only a few evenings—just by following Prof. Pitkin's methods. I found that I could build up a story slowly, leading up to an emotional effect that leaves the reader breathless. Editors and publishers began to write to me, asking for my short stories and offering me startling prices.

Soon I found that I had to give up my position as secretary. My writing brought me such a fine income that I felt that I must devote more time to it. A newspaper heard of me, somehow, and sent me to California to get material for a series of short stories. It seemed as though a new world had opened up for me—a world filled with pleasure, happiness and hope.

Well, now I am writing "movie" stories. I realized early that there is a very big demand for them. And the valuable information I gleaned from Prof. Pitkin's "How to Write Stories" enabled me to write the kind of stories that producers actually clamor for. I usually write one or two a week, and spend the rest of my time traveling about in my car, seeking new experiences, new characters for my writing. Oh, it is a glorious life!

"How to Write Stories" By Prof. Walter B. Pitkin

I have been asked to mention here, at the end of my story, that any man, woman or child who has any desire whatever to write stories, who has any ambition to succeed as I have, can have Prof. Pitkin's wonderful course on "How to Write Stories" sent to them absolutely FREE for five days.

Whether you believe that you can write stories or not, I would strongly advise that you send for this remarkable course. It costs you nothing to see for yourself what a splendid help it is. Each page is crowded with valuable information.

Don't send any money. Just mail the coupon which has been added for your convenience, and Prof. Pitkin's course will be sent to you at once. Glance through it. Read a page here and there. Decide for yourself whether or not you want to do without it. Then, after five days, if you are thoroughly delighted send us $5 in full payment, or return the course and you won't be out a cent.

Remember, the portals of successful authorship open easily to those who have mastered the technique of short story writing. Don't delay. There is big money in the field for every one. Mail the coupon NOW.

Independent Corporation, Dept. K-774, 319 Sixth Ave., New York

INDEPENDENT CORPORATION
Dept. K-774, 319 Sixth Ave., N. Y. C.

You may send me Prof. Pitkin's Course "How to Write Stories." After 5 days I will either send you $5 in full payment, or return the course to you and pay you nothing.

Name.....

Address.....Pop.Sc. 4-21

What Others Say:

The training I received under Professor Pitkin stood me in good stead. I wrote occasional stories after leaving his course, but later found occasion to apply the great truths of narrative development and character delineation in the problem of news writing. I predicate my success as a news writer and foreign correspondent upon knowledge of the underlying principles of writing as taught by Professor Pitkin. I am at present American correspondent for the Australian Press Association, with two associates in New York and Montreal, serving 300 newspapers in Australia and New Zealand with world news.

A. ROTHMAN,
Amer. Correspondent for Australian Press Assoc., N. Y.

During the last year I sold two short stories and two one act plays, thereby adding several hundred dollars to my income. The only reason that I did not sell more was that I had no more time for story writing after teaching thirty hours a week, running an apartment in New York and a house in the country, and writing and staging two pageants that involved training and costuming one hundred children. I write these biographical details to show what inspiration and training were in be had from Professor Pitkin's work even for a busy woman.

MISS MARY CHALMERS,
242 Lexington Ave., N. Y. C.

CONTENTS—*Continued*

(Continued on page 8)

The Letter that Saved Me 36% on Typewriters

Received by a Business Man from a Buyer Friend

Chicago, Nov. 2, 1920.

Dear Henry:

I hear that you are down in New York to open a branch office for your firm. You'll be buying a lot of things for the office, not the least important of which will be typewriters.

And that's what I want to talk to you about—typewriters. I want to give you the benefit of an experience I had some time ago, and thereby, I hope, save you some real money.

About a year ago I decided to buy a typewriter for home use. My first thought was to purchase one of the makes we were using in the office, which had been put in before I became buyer for the house. But when it came to digging up a hundred dollars for the machine—I just couldn't. Somehow or other it looked like too much money to me.

Then I thought about picking up a second-hand machine, but the price was about as high, and I had no assurance of service.

I was undecided as to what to do, when one evening at home I ran across an Oliver Typewriter ad in a magazine. I remembered then having read the advertising before and being impressed with the story.

"Why pay $100 for Any Typewriter"—"When You Can Buy a New Oliver for $64?" read the ad—then it went on to explain how The Oliver Typewriter Company had cut the price by selling direct and eliminating costly selling methods. It was clear to me as an experienced buyer how they could well afford to top off $36 of the $100 by their new economical selling plan.

The ad brought out the fact, too, that I didn't have to pay the $64 in a lump sum. I could settle at the easy rate of $4 a month. Naturally that appealed to me, for it was as easy as rental terms.

But the thing that decided me was their free trial offer. Without my sending or depositing a penny, they would ship me an Oliver for five days free trial. I could use the typewriter for five days just as if it were my own, and if I wasn't satisfied, all I had to do was to ship it back at the Oliver Company's expense. Well, I mailed in the coupon and got an Oliver for free trial. To make a short story shorter, I was more than pleased with the Oliver. I fully agreed with The Oliver Typewriter Company that if any typewriter was worth $100 it was this splendid Oliver.

Well, later when we found it necessary to replace some of the typewriters at the office, you may be sure I put in Olivers, saving the company a nice $36 on each. At first the girls were reluctant about changing machines, but after a week or two with the Oliver, they wouldn't have any other.

Naturally now we are all Oliver enthusiasts—that's why I write this letter to you.

You just give the Oliver a trial and you'll be more than willing to buy me a good dinner when I arrive in New York next month.

Yours, J. B.

That is the letter that saved me $36 on each of my typewriters. I not only equipped the office with the Oliver, but like my friend I also bought one for home use. Yes, I am more than willing to buy my friend a good dinner for his valuable advice.

Any reader may order an Oliver direct from this ad by mailing the coupon. No money in advance. No deposit. No obligation to buy. Return or keep the Oliver as you decide after five days free trial. If you decide to keep the typewriter, you may take a year and a half to pay at the easy rate of $4 a month. Mail the coupon today—NOW.

Canadian Price $82

The OLIVER Typewriter Company
1104 Oliver Typewriter Bldg., Chicago, Ill.

Was $100
Before the War
Now $64

FREE TRIAL
Send No Money

A Finer Typewriter at a Fair Price

Over 900,000 Sold

Save $36

THE OLIVER TYPEWRITER CO.
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☐ Ship me a new Oliver Nine for five days free inspection. If I decide to keep it I will pay $4 a month until the total price of $64 is paid. Title to remain in you until fully paid for.

My shipping point is .....
Title does not pass, nor any order or obligation to buy, created by signing this coupon. If I choose to return the Oliver, I will ship it back at your expense at the end of five days.

☐ Do not send a machine until I order it. Mail me your booklet, "The High Cost of Typewriters—The Reasons and the Remedy," and let me have catalog and further information.

Name .....

Street Address .....

City ..... State .....

Occupation or Business .....

CONTENTS—*Continued*

Has This Ever Happened to You?

IF you were a guest at dinner and you overturned a cup of coffee, what would you do? What would you say? Would you turn to the hostess and say "I beg pardon?" Would you offer your apologies to the entire company? Would you ignore the incident completely? Which is the correct thing to do?

To be able to do and say the right thing at the right time is the badge of culture, and the man or woman who has that power is indeed an individual of polish and poise.

What Do You Know About Introductions?

To establish an immediate and friendly understanding between two people who have never met before, to make the conversation flow more smoothly and pleasantly, to create an agreeable, harmonious atmosphere—that is the purpose of the *introduction*. A correct, courteous conversation-making introduction is an art itself, and reflects refinement and cultivation on the person who is the medium.

How do YOU introduce two people? Do your introductions create a pleasant, easy atmosphere, or one that is uncomfortably strained?

Try this simple test and see what you really know about the art of introduction:

Mrs. Brown and Miss Smith have met at your home for the first time. Would you say, *Mrs. Brown, meet Miss Smith*, or *Miss Smith, meet Mrs. Brown?* Would you say, *Miss Smith, let me make you acquainted with Mrs. Brown?*

If Mr. Blank happened to drop in for a little chat, how would you present him to the ladies; to both at once, or to each one individually? And how would you present Bobby, who comes running in from school: *Bobby, this is Mr. Blank*, or *Mr. Blank, this is Bobby*, or would you use the *I want you to meet* method? Do you ever say *I take pleasure in introducing?* Is it right or wrong?

How do you introduce a sweetheart to your relatives for the first time? How do you introduce her, or him, to your friends?

On the other hand, if you are being introduced, how do you acknowledge it. Do you use any of these expressions: *"Pleased to know you," "Delighted," "How do you do?"* Does a gentleman rise upon being introduced to a lady? Does the lady rise? Is it correct for the lady and gentleman to shake hands?

The difference between the right and wrong thing in introducing, is the difference between culture and coarseness.

The man who would be polished, impressive, and the woman who covets the wonderful gift of charm must cultivate the art of introduction.

Etiquette at the Dance

The ball-room should always be a center of culture and grace. To commit a breach of etiquette at the dance is to condemn yourself as a hopeless vulgarian. But alas! how many blunders are made by people who really believe they are following the conventions of society to the highest letter of its law! What blunders do you make in the ball-room? These questions may also help you discover them.

Does etiquette allow a woman to ask for a dance? May she refuse to dance without a reason? What is the proper thing for a young girl to do if she is not asked to dance? What is a polite and courteous way of refusing a dance? How many times may a girl dance with the same partner without breaking the rules of etiquette? Is it correct to wander away from the ball-room with a fiance?

According to etiquette's laws is it necessary for a gentleman to dispose of his partner to some one else before he asks another lady for a dance? How shall he ask a lady to dance? Which are the correct forms and which the incorrect? How shall he dispose of the lady after the dance, if he must return to the lady he has escorted? What is the right dancing position for the gentleman? For the lady? What style of dress is correct to wear at a dance?

There is perhaps no better place to display the culture and finesse of your breeding than the ball-room, resplendent with the gay gowns of women and enchanting with the ease and gracefulness of dancing couples. Here the gallantry of true gentlemen and the grace of delicacy of cultured women asserts itself. Here you can distinguish yourself either as a person of culture or a person of boorishness.

When Wedding Bells Ring

etiquette again comes to the fore. What is the right dress for the bride to wear? How shall the invitations be worded? When shall the groom give his farewell bachelor dinner? How shall congratulations be extended? And after the wedding there are cards of thanks and cards of invitation to be sent. The wedding breakfast must be arranged and perhaps a honeymoon trip must be planned. Suffice to say that the bride and bridegroom will find invaluable aid in the "Encyclopedia of Etiquette."

Encyclopedia of Etiquette

In Two Comprehensive Volumes

In the most minute details of daily life, in the hours of prosperity and adversity alike, at all times, there is the omnipresent need of holding one's self in hand, of impressing by one's culture and breeding, of *doing the right thing*. Culture is, after all, one of the fine arts. To excel in music or painting, the price is vigilance, study and incessant effort; to be cultured, polished, the price is conscientious effort and study.

"Clothes may make the man," but whether you are clothed in rags or silks your culture can not be hidden. For he who is polite, refined and well bred wears a gorgeous robe endowed with the fine embroidery of honor and respect. Not even rags can cover it.

The world is a harsh judge, but it is just. It will not tolerate the man who makes blunders at the dinner table. It will not tolerate the woman who breaks the conventions of society at the dance. It will not tolerate the illiterate in the Art of Etiquette.

"Encyclopedia of Etiquette" is excellent in quality, comprehensive in proportions, rich in illustrations. It comes to you as a guide, a revelation toward better etiquette. It dispels lingering doubts, corrects blunders, teaches you the *right thing to do*. It is a book that will last. You will preserve it, to refer again and again to its invaluable aid toward culture and refinement.

New Chapters on Foreign Countries

Two new and interesting chapters have been added to the original edition of the "Encyclopedia of Etiquette." They are "The Etiquette of Travel" and "The Etiquette in Foreign Countries." The woman who is traveling alone must be extremely circumspect in her conduct. The conventions of etiquette must be strictly observed. The man who is escorting a woman abroad must not subject her to embarrassment by blunders in etiquette. Tips, dress, calling cards, correspondence, addressing royalty and addressing clergy abroad are discussed and the dinner etiquette in France, England and Germany is discussed. The two chapters are brimful of hints and pointers for the man or woman who travels.

This is the first time that a complete and intensive two-volume set of the "Encyclopedia of Etiquette" has been offered. The edition will go quickly. Don't delay—send for your set NOW before you forget.

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The coupon below entitles you to 5 days' FREE examination of the two-volume set of the "Encyclopedia of Etiquette." At the end of that time, if you decide that you want to keep it, simply send us $3.50 in full payment—and the set is yours. Or, if for any reason you are not satisfied, return it to us and you won't be out a cent.

You owe it to yourself and to the children in your home to have a set of "Everyman's Encyclopedia of Etiquette" in your library. This opportunity may never come again. Send for the set today and surprise your friends with your knowledge of the correct thing to do, say, write and wear at all times. Just mail the coupon—don't send any money.

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AVIATION

THE American School of Aviation announces a new correspondence course in Mechanics of Aviation. A thorough training in practical aeronautics. American School of Aviation, Dept. 1891, 3601 Michigan Avenue, Chicago.

INVENTORS desiring information write for our Free Illustrated Guide Book and Evidence of Conception Blank. Send model or sketch of invention for our opinion of its patentable nature. Highest references. Prompt service. Reasonable terms. Victor J. Evans & Company, 151 Ninth, Washington, D. C.

PROPELLERS for air propulsion. 5 ft. diameter $12. Other sizes in proportion. Hub mountings, bearings, sprockets and countershafts complete. Full scale blue prints for motorcycle-driven snow and ice sleds, 75c. Ford type, $1. Crawford Motor and Aeroplane Mfg., 142 South Rampart Street, New Orleans, Louisiana.

NEW Airplane Free. Our Airplane School opens new class April 21, 1921; offers course of study requiring common school education, takes six months, costs $500.00. Course includes aeronautical designing, building, complete course in flying, flyer's license and without further cost a new 3 passenger airplane which has passed U. S. Gov't. inspection and cost over $8000.00 to build. Investigate this proposition immediately. Limit under this offer 100 airplanes. Educational Dept., Poll-Kells Corporation, Airplanes and Motors, 137 Pearl St., Buffalo, N. Y.

STAR JR. Biplane Plans, $5. Circular "P" with Special Offer, 5c. Chicago Aero Works, 326 River.

CORPORATIONS

DELAWARE Charters, best, cheapest, free instructions. Colonial Charter Company, Wilmington, Delaware.

FOR THE HOME

GRANDFATHER'S Clock Works $5.00. Build your own cases from our free instructions. Everybody wants a hall clock. You can make good profit building artistic clocks for your friends. We replace worn-out works in old clocks with works having chimes at money saving prices. Write for folder describing the most beautiful hall clock ever sold at $35.00. Clock Co., Nuntown, Pennsylvania.

Quick-Action Advertisements continued on page 10

Five Days to Prove I Can Raise Your Pay

I've done it for thousands of others. I can doubtless do it for you. If I can't then it won't cost you a cent

I MEAN just what I say. There's no trick or catch about it. Give me five days and I'll prove that I can get your pay raised for you. I'll do it on a "show you" basis. You get the proof before you pay me a cent.

You've probably heard of me. My name is Pelton. Lots of people call me "The Man Who Makes Men Rich." I don't deny it. I've done it for thousands of people—lifted them up from poverty to riches. There's no sound reason why I cannot do it for you. So let's try.

Now, follow me carefully. I'm going to tell you exactly how to do it. I'm the possessor of a "secret" for which men have been searching since Time began.

There's no need to discuss the whys and the wherefores of this "secret." Suffice it to say that *It Works*. That's all we care about—*It Works*. Over 400,000 men and women the world over have proved it for themselves. Among them are such men as Judge Ben B. Lindsay; Supreme Court Justice Parker; Gov. McKelvie, of Nebraska; Wu Ting Fang, Ex-U.S. Chinese Ambassador; Governor Ferris, of Michigan, and thousands of others of equal prominence. Some of the things this "secret" has done for people are astounding. I would hardly believe them if I hadn't seen them with my own eyes. Adding ten, twenty, thirty or forty dollars a week to a man's income is a mere nothing. That's merely playing at it. Listen to this:

A young man in the East had an article for which there was a nation-wide demand. For twelve years he "puttered around" with it—barely eking out a living. Today this young man is worth $200,000. He has built a $25,000 home—and paid cash for it. He has three automobiles. His children go to private schools. He goes hunting, fishing, traveling, whenever the mood strikes him. His income is over a thousand dollars a week.

In a little town in New York lives a man who a few years ago was pitied by all who knew him. From the time he was 14 he had worked and slaved—and at sixty he was looked upon as a failure. Without work, in debt to his charitable friends, with an invalid son to support, the outlook was pitchy black. Then he learned the "secret." In two weeks he was in business for himself. In three months his plant was working night and day to fill orders. During 1916 the profits were $20,000. During 1917 the profits ran close to $40,000. And this genial 64-year-young man is enjoying pleasures and comforts he little dreamed would ever be his.

I could tell you thousands of similar instances. But there's no need to do this as I'm willing to tell you the "secret" itself. Then you can put it to work and see what it will do for you. I don't claim I can make you rich over night. Maybe I can—maybe I can't. Sometimes I have failures—every one has. But I do claim that I can help 90 out of every 100 people if they will let me.

The point of it all, my friend, is that you are using only about one-tenth of that wonderful brain of yours. That's why you haven't won greater success. Throw the unused nine-tenths of your brain into action and you'll be amazed at the almost instantaneous results.

The Will is the motive power of the brain. Without a highly trained, inflexible will, a man has about as much chance of attaining success in life as a railway engine has of crossing the continent without steam. The biggest ideas have no value without will-power to "put them over." Yet the will, altho heretofore entirely neglected, can be trained into wonderful power like the brain or memory and by the very same method—intelligent exercise and use.

If you held your arm in a sling for two years, it would become powerless to lift a feather, from lack of use. The same is true of the Will—it becomes useless from lack of practice. Because we don't use our Wills—because we continually bow to circumstances we become unable to assert ourselves. What our wills need is practice. Develop your will-power and money will flow in on you. Rich opportunities will open up for you. Driving energy you never dreamed you had will manifest itself. You will thrill with a new power—power that nothing can resist. You'll have an influence over people that you never thought possible. Success—in whatever form you want it—will come as easy as failure came before. And those are only a few of the things the "secret" will do for you. The "secret" is fully explained in the wonderful book "Power of Will."

How You Can Prove This at My Expense

I know you'll think that I've claimed a lot. Perhaps you think there must be a catch somewhere. But here is my offer. You can easily make thousands—you can't lose a penny.

Send no money—no, not a cent. Merely clip the coupon and mail it to me. By return mail you'll receive, not a pamphlet, but the whole "secret" told in this wonderful book, "POWER OF WILL."

Keep it five days. Look it over in your home. Apply some of its simple teachings. If it doesn't show you how you can increase your income many times over—just as it has for thousands of others—mail the book back. You will be out nothing.

But if you do feel that "POWER OF WILL" will do for you what it has done for over four hundred thousand others—if you feel as they do that it's the next greatest book to the Bible—send me only $4.00 and you and I'll be square.

If you pass this offer by, I'll be out only the small profit on a four-dollar sale. But you—you may easily be out the difference between what you're making now and an income several times as great. So you see you've a lot—a whole lot—more to lose than I.

Mail the coupon or write a letter now—you may never read this offer again.

Pelton Publishing Company
14-H Wilcox Block Meriden, Conn.

PELTON PUBLISHING COMPANY
14-H Wilcox Block, Meriden, Conn.

You may send me "Power of Will" at your risk. I agree to remit $4.00 or remail the book to you in five days.

Name .....

Address .....

A FEW EXAMPLES

Personal Experience

Among over 400,000 users of "Power of Will" are such men as Judge Ben B. Lindsay, Supreme Court Justice Parker, Wu Ting Fang, Ex-U. S. Chinese Ambassador; Assistant Postmaster General Britt; Gov. McKelvie of Nebraska; General Manager Christeson of Wells-Fargo Express Co.; E. St. Elmo Lewis, of Detroit; Gov. Ferris of Michigan, and many others of equal prominence.

$300 Profit from One Day's Reading

"The result from one day's study netted me $300 cash. I think it a great book and would not be without it for ten times the cost."—Col. A. W. Wilde, Roscoe, So. Dakota.

Worth $15,000 and More

"The book has been worth more than $15,000 to me."—Oscar B. Sheppard.

Would be Worth $100,000

"If I had only had it when I was 20 years old, I would be worth $100,000 today. It is worth a hundred times the price."—S. W. Taylor, The Santa Fe Ry., Milano, Tex.

From $100 to $1,000 a Month

"One of our boys who read 'Power of Will' before he came over here jumped from $100 a month to $1,000 the first month, and won a $250 prize for the best salesmanship in the State."—Private Leslie A. Still, A. E. F., France.

LABORATORY AND CHEMICAL

ELECTRIC Furnaces, microscopes, scientific instruments and books are illustrated and described in our new catalogue which has just been issued. Information from D. Altman Company, 223-225 East 110th Street, New York.

CANDY

CHOCOLATE, mint and peanut candy. Best quality. Sent postpaid for 35c stamps. Box 234, Salem, Indiana.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

STAMPING NAMES

MAKE $19.00 Hundred Stamping Names on Key checks. Send 25c for sample and instructions. PS Keytag Company, Cohoes, New York.

ROOTS—HERBS—PLANTS

GINSENG and Golden Seal: Easily grown. Enormous profits. Complete planting instructions and price list of roots and seeds. Free. O. Twitchell, Box V, West Milan, New Hampshire.

DIAMONDS, WATCHES, JEWELRY

$750 Diamond Rings. Wear a "Kimberlyk" FREE. Astounding Offer. Make $50 for yourself. Thomas, 34-2 Rowland Street, Newark, New Jersey.

MISCELLANEOUS

5 MASTER KEYS. Opens and tests thousands of different locks. Numerous experts endorse our keys as a precaution, convenience, necessity, and the most wonderful set of keys. They have satisfied thousands of purchasers, and will satisfy you too. Only $1.00 with Novel Key Chain. Master Key Company, 34 Manhattan Building, Milwaukee, Wisconsin.

HARDWOOD-FLOORS—Clean, renovate and refinish your own floors. Instructions and formulas tell how, also care of floors. Price $1.00. Wm. Spier, 2037 Broadway, Chicago, Illinois.

IMMUNITY from infection. Use I-Wood Sanitary coverings for closet seats. Package containing 6, 15c postpaid. I-Wood, 460 Madison Avenue, Albany, New York.

"CHICAGO Mail Address. Desk room $3.00 up per month. Great Lakes Letter Service, Room 404, 329 Plymouth Court.

DANDRUFF removed quickly, pleasantly, completely. Healthy scalp. For men, women, children. Wonderful benefit. Buy Kotalko at druggist's, or proof box mailed, 10 cents, postpaid. Kotalko Offices, BB-188, Station X, New York.

DEUEL'S Swiss Ointment. Piles, Eczema, Serious Cuts, Burns. Clifford Deuel, Centreville, Michigan.

MAKING paper designs practical suggestions for Mechanics. Suggestions—Designs $2.00. Original Designs. Box 312, Oakland, California.

MONEY in manufacture of Alcohol, Essential Oils, Flavors. New Formula book, $2.00. Hydrometers, $2.00. Circular free. Chemical P. & D. Company, Box 1682, Pittsburgh, Pennsylvania.

STILLS—For Water, Oils, Liquids, all drinking purposes, gallon hourly, $15 up prepaid, circular free. European Supply Company, Box 1682, Pittsburgh, Pennsylvania.

130 ACRES with 9 cattle, 3 horses, hay, vegetables, equipment; good buildings, $3300. Details page 14. Free Catalog Bargains 33 States. Strout Farm Agency, 150BH Nassau Street, New York City.

SIX Oz. Genuine Cowhide Gentlemen belt with sable buckle or without buckle. Best in America. Mailed to any address in the U. S. A. for one dollar; sizes from 40 to 50 for $1.25. Lindy Belt Company, 500 Commercial Place, New Orleans, Louisiana.

ASK your Hardware for Holland Night Latch Lock. Carried in pocket. Instantly attached without tools. Door cannot be opened from outside. Postpaid 75c. Lincoln Holland, Long Beach, California.

TELEGRAPHY

TELEGRAPHY (both Morse and Wireless) and Railway Accounting taught quickly. Tremendous demand. Big salaries. Great opportunities. Oldest and largest school; established 45 years. All expenses low—can earn large part. Catalog free. Dodge's Institute, K Street, Valparaiso, Indiana.

TELEGRAPHY—Morse and Wireless—taught at home in half usual time and at trifling cost. Omnigraph Automatic Transmitter will send, on Sounder or Buzzer, unlimited messages, any speed, just as expert operator would. Adopted by United States Government and used by leading Universities, Colleges, Technical and Telegraph Schools throughout United States. Catalog free. Omnigraph Mfg. Company, Dept. 42, 26 Cortlandt Street, New York.

LEARN telegraphy—Big salaries—steady demand—Write for Catalogue. Barry's Telegraph Institute, 900 Minneapolis, Minnesota.

STAMMERING

STAMMERERS: My simple and natural method will correct your impediments. Instruction individual. Samuel E. Robbins, 246 Huntington Avenue, Boston.

ST-STU-T-T-TERING and Stammering cured at home. Instructive booklet free. Walter McDonnell, 30 Potomac Bank Building, Washington, D. C.

LETTER SPECIALISTS

I WRITE letters that bring replies. Advice free. Al Morse, 2209 Sixteenth, Troy, New York.

FRANCIS Writes the Best Sales Letters in the World. Floyd Delos Francis, Box 604, Atlantic City, New Jersey.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

ADVERTISING SERVICE

BETTER results for less money. Stanford Rate Bulletin, giving rates leading publications, free. A complete service. Stanford Service, Lancaster, Pennsylvania.

PROOF by Performance is the advertising service we offer. Absolute copy results. Richardson Agency, Evanston, Illinois.

ONE Inch Advertisement in 100 Country Town Newspapers, $6.65. Ad-Guide free. Commerdia Magazine, 10 Water, York, Pennsylvania.

BATES "Better Way" Literature and Sales Letters bite costs, jump profits. Request Valuable Free Book to Advertisers, today. Bates Better Way Advertising, Drawer 61, Springfield, Ohio.

ADVERTISERS! Great Results. 30 words one year $2. Circulation 5,000. The West Virginia Advertiser, 523 14th Street, Huntington, West Virginia.

SPECIAL!!! Inch Display advertisement 150 Magazines thrice $15. Page $500. Globe Syndicate, Atlantic City.

OFFICE AND FACTORY EQUIPMENT

ADDRESSORS, duplicators, multigraphs, multicolors, dictating machines, etc. Bought, rebuilt, sold. Office Machinery Company, 22-C Quincy, Chicago.

MULTIGRAPHS, Duplicators, Addressing, Folding, Sealing Machines. Bought, Sold and Rebuilt. Guaranteed. Office Device Company, 154A, West Randolph, Chicago.

MULTIGRAPHS, Addressographs, Duplicators, Sealers, Folders, less than half price. Guaranteed one year. Pruitt Company, 112-M North La Salle, Chicago.

PRINTING, ENGRAVING, MULTIGRAPHING

500 FT. LABELS $2.50. Save 30% on all. Wolf Labels, Station E, Philadelphia.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

LETTERHEADS $2.50 thousand. Samples free. Quality Print Shop, Marietta, Ohio.

100 Letterheads, 100 Envelopes, $1.15. Others reasonable. Economic Printery, Leonia, New Jersey.

BETTER printing for less money! Send for our large package of samples of hundreds of items every user of printing is interested in. These samples worth dollars will be sent for 10 cents to pay postage. Ernest Fantus Company, 525 South Dearborn Street, Chicago.

ENGRAVED stationery at 60% saving. Plates unnecessary. Cards, Letterheads, Announcements, etc. Samples sent. Alden Non-Plate Engraving Company, 13 Avon Street, Boston, Massachusetts.

PACKAGE Labels! Rubber stamps! Samples Free! Edward Harrison, "Stickers," Baltimore.

GUM Labels that stick anywhere. Catalogue free. Box 137, Newfield, New Jersey.

ENGRAVED Stationery at Printers prices. Finest Printing. Send for samples and prices. Medium quantities. Whitworth Burber, 166 North Wells, Chicago.

PRINTING—Multigraphing—quick service, quality work, low prices. Mason Service, Box 612-6, Waterloo, Iowa.

QUALITY Printing—Bond envelopes and letterheads, 100, $.60; 1000, $4.25. Samples free. Spafford & Co., Marcella, New York.

TYPEWRITERS AND SUPPLIES

RE-MANUFACTURED typewriters at reduced prices. Shipped for 5 days' trial. Write for our Catalog No. 25 and save money. Beran Typewriter Company, 58 West Washington Street, Chicago.

FOR SALE

CHOICE Silverblack breeding foxes. Instructions. Reid Bros., Bothwell, Ontario.

FOURTEEN-INCH cut glass Flower Vase, $6.00 postpaid. Send for photo. Box 137, Newfield, New Jersey.

DOGS, BIRDS, PETS

WHITE collies, beautiful, intelligent and useful. The Shomonts, Monticello, Iowa.

GERMAN Shepherd, Airedales, Collies, Old English Shepherd dogs, bred matrons, puppies, farm helpers. 10c for instructive list. W. R. Watson, Box 224, Oakland, Iowa.

REGISTERED Airedales. Best imported American breeding, $15, $35. J. W. Callaway, Belton, Missouri.

FOR MEN AND WOMEN

BE a detective. Excellent opportunity, good pay, travel. Write C. T. Ludwig, 434 Westover Bldg., Kansas City, Missouri.

GENUINE Indian Baskets—Wholesale. Catalogue. Gilham, Highland Spring, California.

STOP Falling Hair. Use Kotalko (sold by druggists) under guarantee. Amazing success, new hair growths when all else failed. Proof box mailed 10 cents. Kotalko Offices, BC-188, Station X, New York.

"SEXUAL Philosophy." 12c. Clear, specific, authoritative, complete, best existing. Fred B. Kaessmann, Lawrence, Massachusetts.

DETECTIVES—Excellent opportunity. Fascinating work. Experience unnecessary. Particulars free. Write, American Detective System, 1968 Broadway, New York.

START silvering portrait, photo and enlargement studio in your home. We guarantee teach you to oil paint portraits without brushes. Beautiful work. No experience, capital or apparatus necessary. Outfit furnished. Free booklet. Start a branch Tangley Studio and make $5,000 yearly. Tangley, 150 Main, Muscatine, Iowa.

MEN or Women—Enormous Profits Selling Duo Guaranteed Products. Easy sales at every house. All or spare time. Outfit free. Write quick. Duo Company, Dept. B56, Attica, New York.

EDUCATIONAL AND INSTRUCTION

LINCOLN-JEFFERSON University. Home study in College, Theological, Law, Music, Pharmacy. Business and Graduate Schools. Leading to degrees. Lock Box 239Q, Chicago.

LEARN French. 16 easy lessons, 60c. Joel Tillburg, Proctor, Vermont.

SURVEYING and Field Engineering taught in 10 weeks. You work on Actual Surveys. General Engineering Company, 357 West 63rd Street, Chicago.

SHORTHAND. Learn complete system, few evenings (hours); then acquire speed pleasant practice. Brochure free. Save money, time, increase your efficiency, earnings. King Institute, EN-188, Station F, New York.

CHEMISTRY at a glance. Learn Qualitative Analysis by the Modern Simplified Chart Method. U.S. and Canada $1.00. Foreign countries $2.00. Technical Charts, Dept. D-1, 1035 West Chicago Avenue, Chicago, Illinois.

PICTURES AND POSTCARDS

JOIN Live Postcard Club. Membership Papers 10c. Harvey Teeple, Decatur, Indiana.

TRUE-BLUE friends everywhere. Exchange postals. Club organized 1908. Membership: Year, $1; half, 50c; quarter, 25c. Book, hundreds listings, 10c. Ed Ermon, P6421 Elroy, Wisconsin.

POSTCARDS of beautiful girls; sample and catalogs 10c. Smith's Art, H6735 Elizabeth Street, Chicago.

PATENTS FOR SALE

PATENTS on following articles for sale outright or royalty. Wonderful massage instrument. Secretary or portable writing desk. Beautiful novel token. New sanitary absorbent pad. Meritorious. Splendid commercial values universal demand. Investigate immediately. M. Y. Heart, 2443 Eighteenth Street, N. W., Washington, D. C.

WE have a few practical money-making inventions for sale or trade. Adam Fisher Mfg. Co., 183B, St. Louis, Missouri.

THE latest and up-to-date patented sifter for flour to crushed-stone. Will sell outright. O. F. Mattingly, 1137 20th Street, N. W., Washington, D. C.

SPARK Plug, new, patented, air-cooled shell or oil-cooled point. Other features. Cash royalty. Postage stamp for reply. J. J. Flaci, Devon, Connecticut.

GAMES AND ENTERTAINMENT

FOUR Magic Catalogs and Samples—10c. Oltmagico, Morgan Park, Illinois.

PLAYS, vaudeville acts, monologs, dialogs, recitations, pageants, musical readings, special entertainments, tableaux, drills, minstrel jokes, make-up goods. Large Catalog free. T. S. Denison & Company, Dept. 29, Chicago.

BOYS fly this model aeroplane. Circular free. Aero Shop 3050 Hurlbut Avenue, Detroit, Michigan.

55 CARD TRICKS, 10c. 200 Puzzles, 10c. 300 Clever toasts, 10c. 24 Mystic photos, 15c. Smith's Novelty, E6735 Elizabeth, Chicago.

LARGE Trick, puzzle and joke catalog with sample, 10c. A. Weiland, 5810 Chester, Philadelphia.

6 CRACKERJACK card tricks, X-ray card, magic envelope, vanishing coin puzzle and catalog of tricks, novelties, etc., 10c. Hermoss, 1627 N. Harding Avenue, Chicago.

ASTROLOGY—Stars tell Life's Story. Send birthdate and dime for trial reading. Eddy, 4307 Jefferson, Kansas City, Missouri, Apartment 100.

PHOTOGRAPHY AND SUPPLIES

FILMS developed 5c roll, prints 3c each. Photo Service, 928 McMillan, Cincinnati, Ohio.

YOUR next film developed—six prints—one enlargement—25 cents (silver). Alves Photo Service, Dept. A, Braintree, Massachusetts.

GILT Edge Enlargement Free with your Kodak finishing, something new, improves pictures 100%. Send for price list of the best quality Kodak finishing, and free offer today. Sunshine Photo Film Exchange, Box 1223, St. Louis, Missouri.

$1.00, 3-8 x 10 enlargements from your own Kodak films. Developing and printing. "Quality first." The Camera Shop, Concord, New Hampshire.

MAKE money with your snapshots of local interest. Profitable spare time work. I will show you how. Send three negatives. C. Coonan, Box 31, Bergenfield, New Jersey.

ALWAYS reliable Kodak finishing. Roll developed and six beautiful velvety prints, 40c. Prints chemically tested, guaranteed permanent. Chas S. Wells, Hiawatha, Kansas.

SPECIAL Offer—Your next Kodak film developed 10c, and first six prints 2c each. 24 hours service. Enclose money with order. Write for price list "3" and sample print. Johnston & Tunick, 53 Nassau Street, New York.

MUSIC AND SHEET MUSIC

ALL MUSICIANS—beginners and advanced—troubled with Weak Lips—High or Low Tones—Fast Staccato—etc., should send for "Free Pointers." Virtuoso School, Buffalo, New York.

LEARN to write songs. A complete course by mail. Send for particulars. Plaza Music Service, 18 Hudson Street, Worcester, Massachusetts.

WRITE the words for a song. We revise poems, write music and guarantee to secure publication. Submit poems on any subject. Broadway Studios, 121C Fitzgerald Building, New York.

YOU Write the Words for a Song. We'll compose the music free and publish same. Send Song Poem to-day. A. G. Lenox Co., 271 West 125th Street, New York.

WRITE a song poem—I compose music and guarantee publication. Send poems to-day. E. Hanson, 3810 Broadway, Room 110, Chicago.

WRITE a Song Poem—Love, Mother, Home, Comic or any subject. I compose music and guarantee publication. Send words to-day. Edward Trent, 631 Reaper Block, Chicago.

WRITE the words for a song! We will write the music and guarantee publication on a royalty basis. Submit poems on any subject. Seton Music Company, 920 South Michigan Avenue, Room 112, Chicago.

Quick-Action Advertisements continued on page 12

"The Job is Yours— on One Condition!"

"For a long time I watched the new men who came into this business. Some stood still—stayed right where they started. Others climbed—made each job a stepping stone to something better.

"Now, what was the difference? Well, I investigated and found out. The men who were getting ahead had been devoting part of their spare time to study along the line of their work. Our treasurer used to be a bookkeeper. The factory superintendent was working at a bench in the shop a few years ago. The sales manager started in a branch office up state. The chief designer rose from the bottom in the drafting room.

"All of these men won their advancements through spare time study with the International Correspondence Schools. Today they are earning four or five times—yes, some of them *ten* times as much money as when they came with us.

"So out of this experience we have formed a policy. We are looking for men who care enough about their future not only to do their present work well, but to devote part of their spare time to preparation for advancement.

"And I'll give you this job on one condition—that you take up a course of special training along the line of your work. Let the I. C. S. help you for one hour after supper each night and your future in this business will take care of itself."

Employers are begging for men with ambition, men who really want to get ahead in the world and are willing to prove it by training themselves in spare time to do some one thing well.

Prove that you are that kind of a man! The International Correspondence Schools are ready and anxious to help you prepare for advancement in the work of your choice, whatever it may be. More than two million men and women in the last 29 years have taken the I. C. S. route to more money. Over 130,000 others are getting ready in the same way right now. Surely the least you can do is to find out what there is in this proposition for *you*. Here is all we ask: Without cost, without obligating yourself in any way, simply mark and mail this coupon.

—TEAR OUT HERE—

INTERNATIONAL CORRESPONDENCE SCHOOLS

BOX 7618-B **SCRANTON, PA.**

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

☐ ELECTRICAL ENGINEER	☐ SALESMANSHIP
☐ Electric Lighting and Railways	☐ ADVERTISING
☐ Electric Wiring	☐ Window Trimmer
☐ Telegraph Engineer	☐ Show Card and Sign Ptg.
☐ Telephone Work	☐ Railroad Positions
☐ MECHANICAL ENGINEER	☐ ILLUSTRATING
☐ Mechanical Draftsman	☐ Cartooning
☐ Machine Shop Practice	☐ BUSINESS MANAGEMENT
☐ Toolmaker	☐ Private Secretary
☐ Gas Engine Operating	☐ Business Correspondent
☐ CIVIL ENGINEER	☐ BOOKKEEPER
☐ Surveying and Mapping	☐ Stenographer and Typist
☐ MINE FOREMAN OR ENGINEER	☐ Cert. Public Accountant
☐ STATIONARY ENGINEER	☐ TRAFFIC MANAGER
☐ Marine Engineer	☐ Railway Accountant
☐ Ship Draftsman	☐ Commercial Law
☐ ARCHITECT	☐ GOOD ENGLISH
☐ Contractor and Builder	☐ Common School Subjects
☐ Architectural Draftsman	☐ CIVIL SERVICE
☐ Concrete Builder	☐ Railway Mail Clerk
☐ Structural Engineer	☐ AUTOMOBILES
☐ PLUMBING AND HEATING	☐ Mathematics
☐ Sheet Metal Worker	☐ Navigation ☐ Spanish
☐ Textile Overseer or Supt.	☐ AGRICULTURE ☐ Teacher
☐ CHEMIST	☐ Poultry Raising ☐ Banking
☐ Pharmacy	

Name_____

Present Occupation_____ Business Address_____

Street and No._____

City_____ State_____

Canadians may send this coupon to the International Correspondence Schools Canadian, Ltd., Montreal, Canada 1-4-21

SONG-WRITERS' Manual and Guide Sent Free. Contains valuable instructions and advice. Submit song-poems for examination. We will furnish music, copyright and facilitate publication or sale. Knickerbocker Studios, 315 Gaiety Building, New York.

YOU write words for a song—we write the music, publish, and secure a copyright. Submit poems on any subject. The Metropolitan Studios, 914 South Michigan Avenue, Room 221, Chicago, Illinois.

PHONOGRAPHS, RECORDS, ETC.

BUILD Your Own Phonograph. Big saving. Pleasant instructive work. Complete instructions, blue-prints, etc., absolutely free. Write today. Associated Phonograph Co., Dept. S, Cincinnati, Ohio.

BUILD a genuine Choraleon Phonograph and save over half. Big profit building and selling. We furnish motors, tone-arms, full instructions and all necessary parts. Send for catalogue and FREE blue print offer. Choraleon Phonograph Co., 421 12th Street, Elkhart, Indiana.

HEAR your family on old record. Easily done without cost or trouble. Instructions 10c. C. MacMahon, 626 North 9th Street, Camden, New Jersey.

MOTION PICTURE BUSINESS

WRITE Photoplays: $50 each. Experience unnecessary; details free to beginners. Producers League, 194, St. Louis.

PHOTOPLAYS Wanted. Big prices paid. You can write them. We show you how. Free particulars. Rex Publishers, Box 175, P 35, Chicago.

AMBITIOUS writers of photoplays, short stories, poems, songs, send to-day for free, valuable, instructive book, "Key to Successful Writing" including 65 helpful suggestions on writing and selling. Atlas Publishing Co., 523 Butler Building, Cincinnati, Ohio.

MAKE $25.00 to $50.00 Nightly. We furnish professional machine, films, supplies, etc., suitable for traveling or stationary use. No experience needed. We teach you this business. Little money required. Easy payments. Large Catalog Free. Dept. 612, Monarch Theatre Supply Company, 228 Union Avenue, Memphis, Tennessee.

LEARN Motion Picture Acting. All ages, both sexes. Experience unnecessary. Particulars for a dime. Picture Acting Institute, Box 141, Station G, New York.

MAKE Your Own Electric Juice. Save Half. Arc Generator. Easy Payments. Your engine operates. Hobbouris, Troy, Ohio.

BIG Money Writing Photoplays. Send for complete instructions free. Studio Scenario Service, Post Office Box 1542, Los Angeles, California.

WRITE Photoplays; $100 each; details free. Los Angeles Photo-Play Company, California.

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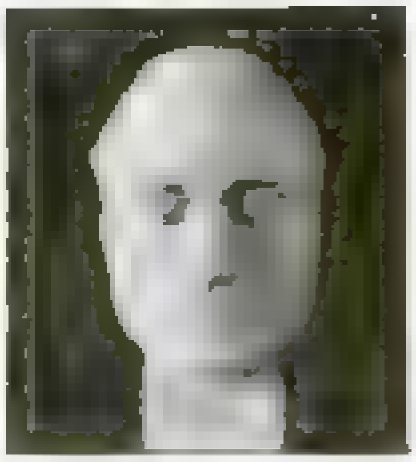

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Author of Characterology

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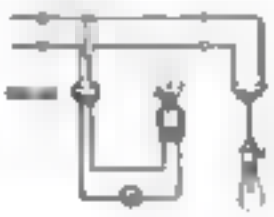

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Popular Science Monthly

Waldemar Kaempffert, *Editor*

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How Much Light Do the Walls Reflect?

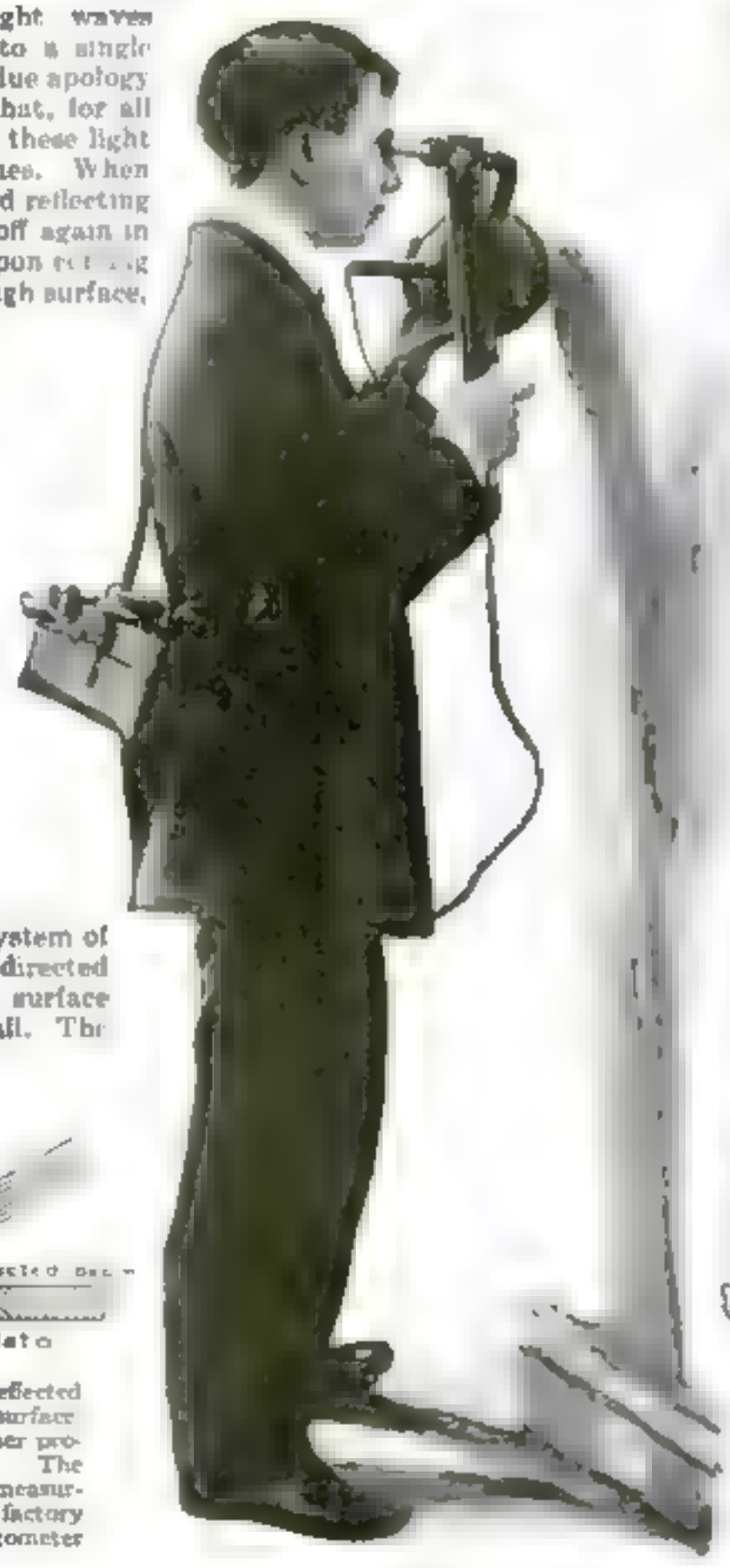
The portable photometer will tell you

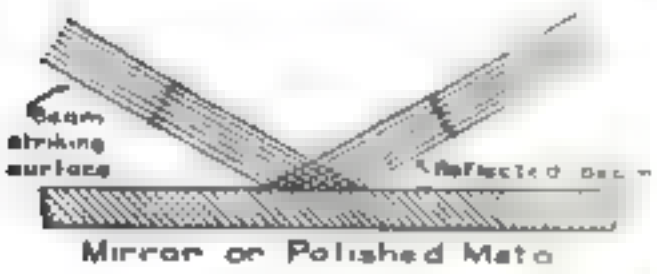
EIGHTY thousand light waves crowd themselves into a single inch of space. With due apology to Einstein, we may say that, for all practical purposes at least, these light waves travel in straight lines. When they strike a highly polished reflecting surface, they are reflected off again in perfectly straight lines. Upon coming in contact with a white, rough surface, a beam of light is broken up into a number of smaller rays that strike off by themselves in divers directions.

We have long known how to produce light, but it is only recently that we have discovered the correct way to use it. Uncontrolled light is destructive, like many other uncontrolled natural forces. When light is reflected from a highly polished surface, it strikes the eye in a concentrated beam. Such reflection produces glare, and glare injures the eyes. With the indirect system of lighting, the light is first directed against a rough reflecting surface like a plastered ceiling or wall. The light waves, striking this surface, are broken up into smaller beams, which are reflected around the room. The resulting illumination is soft and restful to the eye.

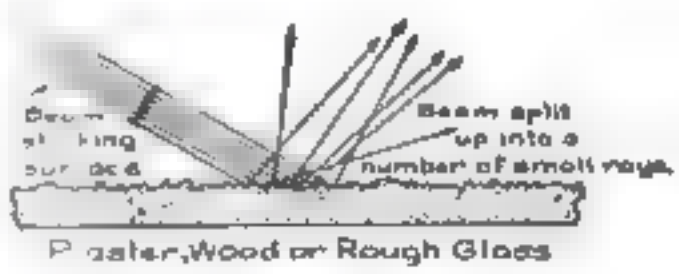
The walls and ceiling of a room greatly influence the distribution of light. To measure the reflecting factor of walls and ceilings, so that lighting systems for offices and factories may be properly designed and installed, a "reflectometer" is used. A short time ago it was necessary to cut a piece of the wall out and carry it to the laboratory, where the reflecting tests were made. A portable device has now been perfected that can be used on the wall itself to obtain immediate results.

A sphere with an open side is placed against the surface to be tested. The interior of this sphere is illuminated with a tiny lamp that obtains its current from a battery carried in the box shown. A special light measure, called a photometer, is attached to the sphere. The comparative reflecting strength of walls may be determined immediately. It requires only a simple formula to obtain the reflecting factor.





How a beam of light is reflected from a smooth, polished surface. Light reflected in this manner produces an injurious glare. The center figure shows a man measuring the reflecting factor of a factory wall with the new reflectometer



How a plastered surface reflects light. The beams striking the surface are broken up into smaller beams that leave the surface in different directions. No glare is produced and a softer light naturally results

Tapping the Earth's Interior for Power

A great reservoir of energy for possible future use

By Alfred J. Lotka

A CUBICAL block 8 miles high, 8 miles broad, 8 miles deep—such, it is estimated, is the total stock of coal beneath the United States' soil to a depth of 3000 feet.

Each year a slice is taken off this block. In the last hundred years 210 feet were brought down. But this is no indication of the rate of consumption, for in the year 1917 alone as much coal was mined as in the first sixty years of the century of coal production. If we continue to consume coal at the present rate, the entire block will be burned up in about 4000 years. Judging from past indications, exhaustion will come much sooner.

In other fuels the situation is even worse. The Geological Survey estimates that more than 40 per cent of our mineral oil has already been consumed, and that the remainder can hardly last twenty years.

Fuel Gone—What Then?

Do you realise what this means? It has been remarked that "back of every man in the United States, reenforcing his strength for the year's work, there is the energy of 6¾ tons of coal." How, then, is the work of civilized communities to be accomplished if this backbone of our industries is taken away? The situation that may confront us before many generations have passed will be far more desperate than the greatest catastrophes of history.

What other sources of energy are available? Wind, wave, and tide are not likely to contribute much more to our needs in the future than they have in the past. There is, of course, much available water power running to waste. But water power has its limitations. Then, still waiting for solution, there is the problem of the direct utilization of the sun's radiation. This is likely to play an important part.

But there is another source almost wholly untapped. We are sitting on a furnace, so to speak. No one knows, even approximately, the temperature inside the earth. Actual measurements made in mines and deep boreholes show that, on an average, the temperature rises about 1° F. for every 60 feet that we go down

If this rate of increase continued to the center, we should have there a temperature of over 300,000° F., an utterly impossible figure, far exceeding our estimates of the temperature of the sun. Professor Strutt, the English physicist, supposes that the temperature rises uniformly to a depth of 30 miles, and after that remains constant at 2700° F

Courtesy of Harpe

Sir Charles Parsons, the distinguished English engineer responsible for the steam turbine of to-day has made the startling suggestion that a bore-hole be sunk deep into the earth. His prime object is the exploration of the earth s crust but he has a so in mind the tapping of the earth s stores of internal heat for power. The earth gives off this heat constantly day and night

Whenever a volcano boils over, we have striking evidence of vast amounts of energy going to waste, or even causing destruction of property and human life.

Not only in volcanoes is this waste going on. The earth is giving off heat day and night. We remain unconscious of this because the flow is steady, and, except in direct sunlight, we have no ready means of distinguishing between the heat contributed from the earth and that derived from the sun. In point of fact, the heat given off by the earth is by no means trifling. It is sufficient to melt, in the course of a year, a layer of ice covering the entire earth to a depth of 4 inches. To put the matter in another way, it is the equivalent of about 5 horsepower an acre of the earth's surface.

Italy Runs Engines with Volcanoes

For practical purposes this stream of energy is too slow, even if it were in a form available for mechanical purposes, which it is not; for heat energy,

in order to be useful, must be presented at a temperature different from that of its surroundings. At the earth's surface the heat comes out, of course, at practically the same temperature as the surroundings.

But suppose we dig down into the earth. Then we can draw out heat energy in available form—that is to say, at a high temperature, much as we would draw water from a well. We can also choose a favorable spot at which to locate the plant. The earth's heat is unevenly distributed. It is more in evidence in volcanic regions. Just as we, in certain parts of this country, can push a pipe into the ground and draw off natural gas for our houses, so in the neighborhood of Lardarello, Italy, if you want to run an engine, you simply tap the earth for steam. To-day more than 10,000 horsepower from this source is converted into electrical energy.

The Lardarello development is primarily of local interest. We can not all get steam from our back yard by going a few feet into the ground.

"Dig Down Twelve Miles," Says Parsons, "and Take Power"

Of more general interest, therefore, are the plans discussed by the British engineer, Sir Charles A. Parsons, of turbine fame, to make a deep bore-hole into the earth. His prime object is the exploration of the earth's crust, but he has also in mind the recovery of power from such bore-holes.

Sir Charles Parsons proposes the sinking of a shaft to a depth of twelve miles. Can it be done? Would not the pressure of the overlying rock at that depth cause the sides of the shaft to collapse? How does the pressure inside the earth increase as we go down? This pressure would be easily computed, for any desired depth, if the earth were liquid (molten). On this assumption, it is found that the pressure at the center of the earth reaches the respectable figure of 3,000,000 atmospheres, a pressure that would compress the air in a room 13 by 17 by 8 feet to a space of 1 cubic inch, if ordinary laws held at such high pressures.

But, in point of fact, the outer crust of the earth is not liquid; it is solid. Each layer forms an arch, supporting the layers above and thus protecting the layers below.

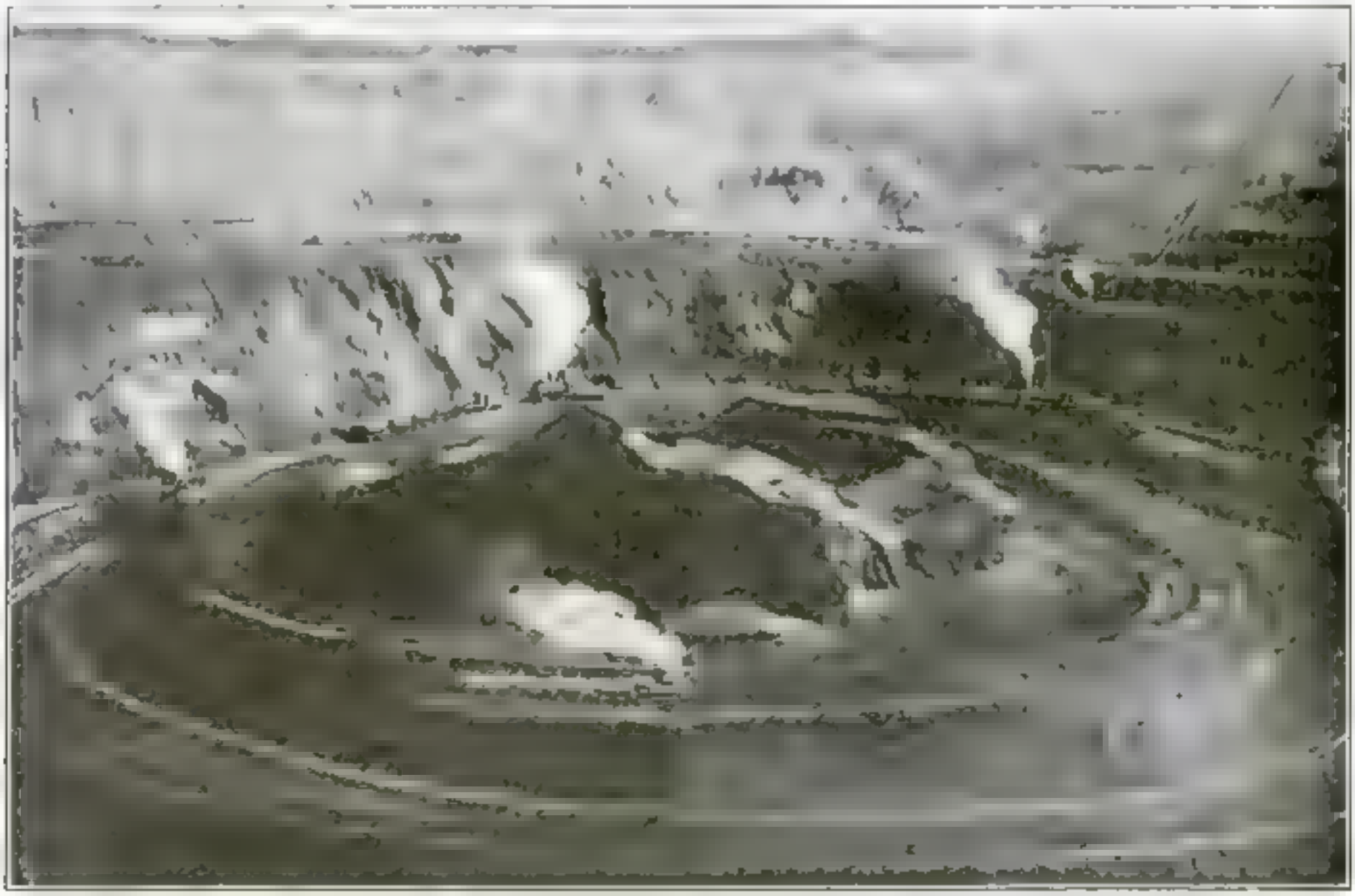
This, of course, would tend to reduce the pressure at the center. But inasmuch as there has been time, in the millions of years that have passed, for these arches to be crushed and to crumble, the estimate of the pressure at a given depth within the earth, based on the assumption that the earth is liquid, probably comes nearer the mark than would at first sight be expected.

Professor Frank D. Adams has carried out some experiments to determine the "zone of flow" of the earth's crust—that is to say, the depth at which rocks fail to sustain the load above them, and would give way to inequalities of pressure in the same way that a sticky liquid like molasses does. He concludes that for limestone this depth is probably not less than 15 miles, while for granite 30 miles would probably be practicable.

The engineering problems to be faced in sinking a shaft even 12 miles would not be trifling. The air pressure would be doubled every 3 miles down. This would necessitate the installation of air-locks at every second or third mile.

A Gigantic Ice-Box to Keep the Workers Cool

A cooling plant would have to be built. If we assume a rise of 1° F. for every 60 feet of depth, at a depth of 12 miles a temperature of over 1000° F. would be reached. Sir Charles Parsons, however, bases his plan on the assumption of a temperature of 272°. He suggests, for the cooling apparatus, two large steel pipes, an upcast and a downcast pipe, connected at top and bottom every half mile, to form a closed ring. This ring would be filled with brine, which, by natural circulation, would effectively carry away heat. The circulation, assisted by electrically driven pumps, would be capable of carrying



In order to tap the earth's interior for power, Sir Charles Parsons proposes the sinking of a shaft to a depth of twelve miles. Nothing comparable with such a huge hole is to be found on the earth. But we present this picture of iron-ore mining because it gives some idea of the way in which large-scale mining operations are conducted

If any one argues that it is fantastic to suppose that we can tap the interior of the earth for power let him turn to Italy and see what she has done.

enormous quantities of heat to the surface. At each half mile stage there would be transfer of heat from the ring above to the ring below by means of an apparatus similar to a feed-water heater, or to a regenerator, constructed of small tubes, through which the brine in the ring above would circulate, while the brine from the ring below would pass through the spaces around the pipes. At the top or at intermediate points the brine would be cooled by refrigerating machinery.

Into the Bowels of the Earth

The cost of boring the 12-mile shaft is placed by Sir Charles Parsons at $25,000,000, and the time required to complete the task at 30 years.

Let us suppose that such a bore-hole has been made, or even one going right through the earth. What would we find the inside of the earth made of? We can only guess. A shaft bored from pole to pole would be nearly 8000 miles long, whereas the deepest bore-hole in existence is less than 1¼ miles deep.

Still, there are some things we can state with assurance. It is certain that the core of the earth is denser, heavier, bulk for bulk, than the crust. On an average, a cubic foot of the earth's crust weighs from 160 to 175 pounds. Now, the earth as a whole has a mass of 6½ million billion billion tons, while its volume is about 38 million billion billion cubic feet. Hence, on an average, taken through the entire volume of the earth, a cubic foot weighs about 341 pounds, or about twice as much as the material at the surface. This is not very astonishing. There must be a general tendency for the heavier substances to gravitate toward the center.

We have noted that the temperature increase with depth observed at the surface can not possibly continue to the center of the earth. Nevertheless, there can be little doubt that the temperature rises above the melting-point of the rocks of the crust.

Is the core of the earth, then, a sea of red-hot molten lava? This does not follow. At the high pressures prevailing, as we have seen, in the interior, melting may not occur, in spite of the high temperature. We can form a picture of the earth's internal condition from phenomena observed at the surface. Earthquakes, for example, tell us much. Their speed has been measured, and the measurement proves that the earth inside is rigid and not liquid. Then there are the tides. If the earth had a perfectly liquid core, thinly covered with a yielding crust, we would observe no tides at all. Why not? Because the land would heave in unison with the sea. On the other hand, if the earth were perfectly rigid, the tides would attain a maximum. From the tidal effects actually observed, which fall between these two extremes, but much nearer to the latter, the rigidity of the earth was estimated by Lord Kelvin to be somewhere between that of glass and that of steel. More recent estimates place it higher, making it about one and one half times that of steel.

Since we are discussing the various observations that might be made in a deep bore-hole, we may briefly consider how the force of gravity varies inside the earth. If the earth were a perfect sphere of uniform density, the weight of an object would diminish continuously as it moved from the surface to the center of the earth, and at the center bodies would have no weight at all. Suppose a complete tunnel were bored from pole to pole, and a stone dropped into it. What would happen to the stone? It would fall for about three quarters of an hour, by which time it would have reached the opposite pole; it would then start falling back to the center, oscillating like a pendulum. Incidentally, its period of vibration would be such that a moon or satellite, revolving about the earth just far enough away to clear its surface, would exactly keep time with the oscillations of this falling body.

We Must Develop Nature's Gifts

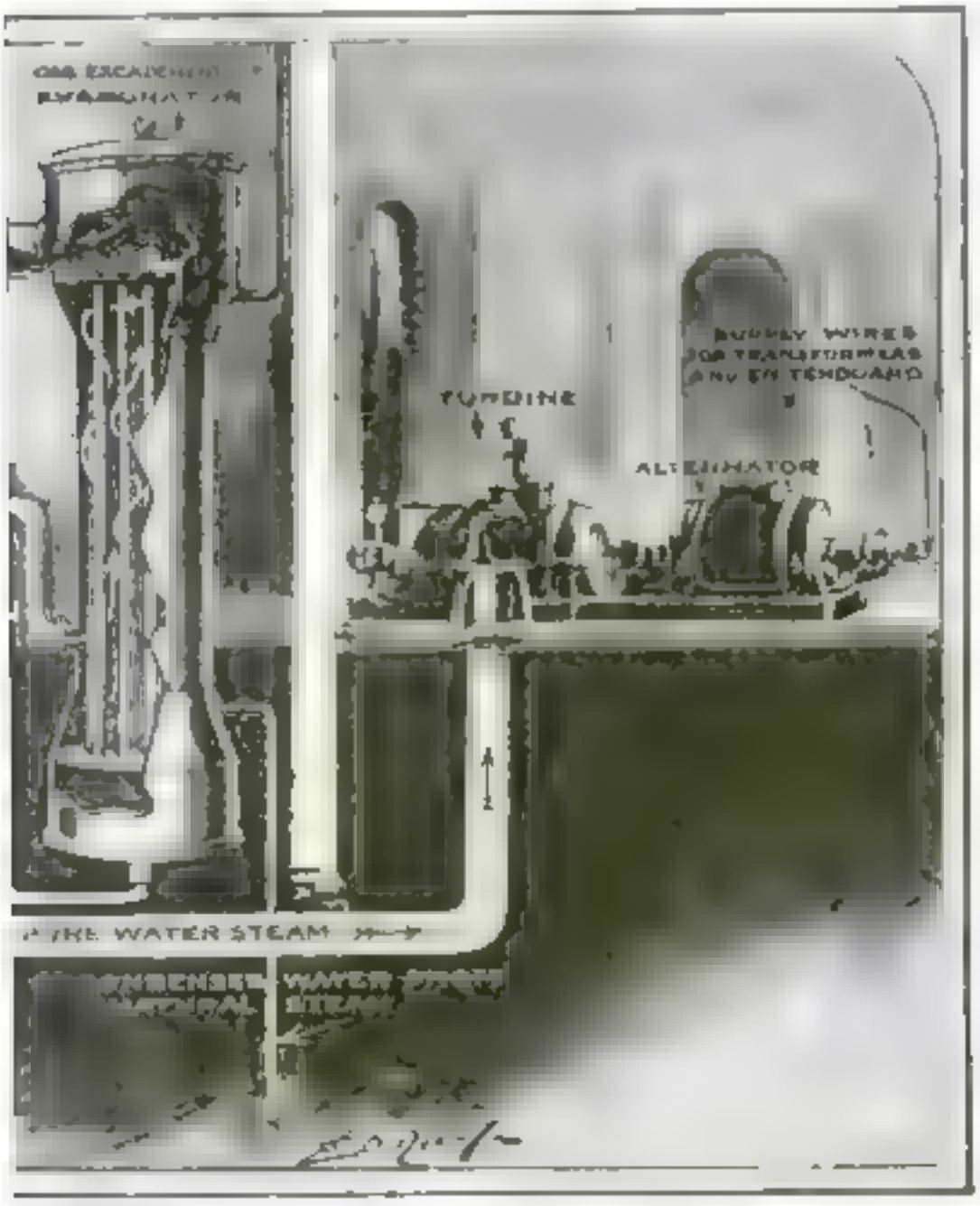
Owing to the increase in density of the earth as the center is approached, the force of gravity in deep borings increases at first as we descend. It has been computed that this increase would continue to a depth of about 800 miles, where it would reach a maximum about 6 per cent in excess of its value at the surface.

The key to success is an adequate knowledge of the world in which we live. The rise and fall of nations is dependent not so much upon the natural resources that they command as upon the genius they exhibit in making practical use of these resources. We see Russia and China, with all their natural wealth, lying fallow for centuries, because their inhabitants have not learned to seize, for the use of man, the wonderful opportunities lavished upon them by nature.

We may have severe trials before us. Our staple source of energy will some day fail. But never, while the sun pours out its golden flood of light, can we complain of actual poverty. And the very earth beneath our feet, though her light died out in ages long gone by, still sends forth heat, representing thousands of millions of horsepower, wasted upon empty space.

The power is there. It is for us to make use of it.

How Italy Makes Volcanoes Drive Her Machines



More than 10,000 horsepower from this source is converted into electrical energy and distributed to villages and traction companies. Lardarello gets steam from its back yard

The two halves of the two sections of the buildings do not coincide. This solves the elevator problem and stimulates the erection of tall garages

Up Six Flights in a Garage

IN crowded cities like New York, where people live in apartment-houses and where there is not much room for individual garages, how can you keep your automobile? Space in cities is so costly that only a tall building is practical for a garage, but the use of elevators is undesirable. Ordinary motor-ramps are too steep.

Fernand E. d'Humy, an American engineer, found himself facing this problem when he moved from a suburban home to a city apartment. He devised and patented a thoroughly practical plan. Imagine a six-story building built in two sections or units separated by a vertical partition wall. The floors and ceilings of the two sections are not on a line, for the floor of one corresponds with a point midway between the floor and ceiling of the other.

Thus an inclined passage from the floor of one unit to the floor of the other unit leads only half a story at a step, and the motor-cars can be run easily upgrade without too steep an incline. The motor-ramp can be arranged in the form of a curve, or it can be straight.

Hanging Electric Lights as You Do Pictures

WITH a device patented by Cantelo White, a New York lighting expert, it is as easy to install electric-light fixtures as it is to hang pictures.

With the new arrangement a tenant can remove a lighting fixture with the motion used in taking his hat off a hook. He may also place the same fixture in another part of the room in one or two seconds.

A new kind of plug, with curved blades instead of the usual straight ones, and a new type of electric outlet to hold it, are the essentials of the new device. The outlet is much like the ordinary baseboard receptacle. The two parallel slots that admit the curved-blade plugs are curved upward. They will also accommodate the standard plug.

With this invention lighting fixtures may be moved from one part of a room to another

This Soldering-Torch Uses Two Fuels

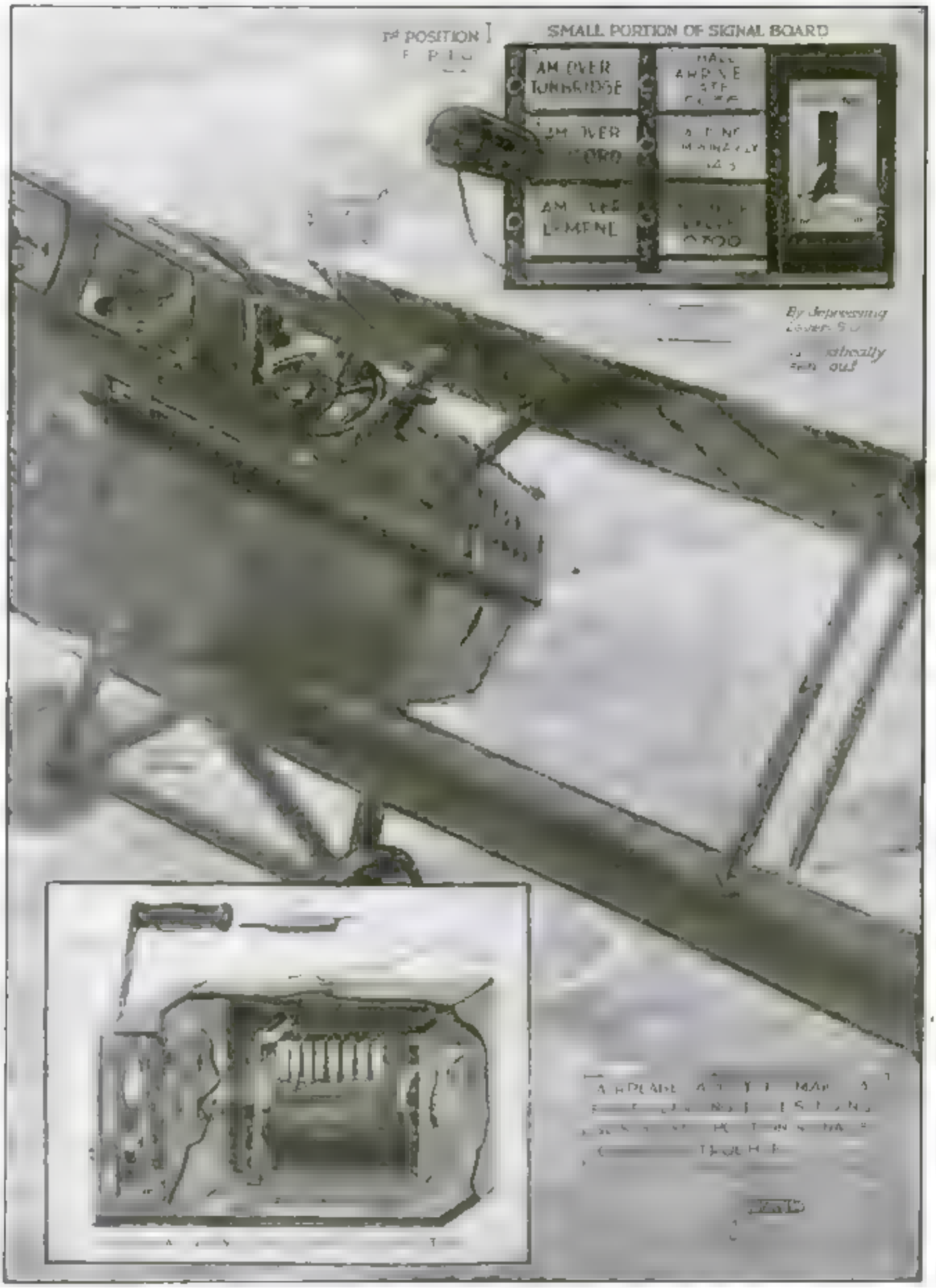
THE steady hand of a good mechanic is needed to apply solder. Many people find this out after they make several attempts to mend the teapot or the wash-boiler. It is indeed aggravating to see the solder roll off in small balls as fast as it is applied. After a little experience, the would-be mechanic generally ends up by taking it for granted that soldering is a difficult job that only a mechanic can accomplish.

An inventor has done a great service and filled a long-felt want by developing a blow-torch that any one can use in soldering. No soldering copper is needed. The most inexperienced person can make solder stick with this little torch. The flame is applied directly to the piece to be soldered. When it has reached the proper temperature—hot enough to melt the solder—the solder is brought in contact with it.

Two separate compartments make up the torch. They contain different fuels. One fuel feeds the burner while the inflammable vapor of the other is blown into the flame. This is done with a little hose that the user blows through. A very hot flame is produced. The flame is hot enough to bring metal to a red heat. The little torch may be used for light brazing as well as soldering.

Many household objects may be rescued from the family scrap-heap by the use of the little soldering-torch. Mother's favorite kettle may be saved, also umbrellas and saucepans.

Anybody can use this blow-torch to mend the family teapot or a favorite box; no soldering copper is needed



Drawing by G. M. Davis

"I Am Over Ashford," Says This Airplane Automatic Wireless

Until recently it has been necessary for an airplane to carry an operator for wireless in addition to the pilot When the pilot wished to send a message, he first had to get it to the wireless man, who relayed it on to the world below.

Now there has been perfected a device for sending wireless messages automatically, and the pilot can do his own wireless-ing. He can do this without even knowing the code.

This new automatic wireless transmitter will send any one of sixty radio messages by merely pulling a handle after inserting a plug in a hole labeled with the desired message

Looking at Dew through a Microscope

Courtesy of the Bray Studios

Strings of pearls? That's what they look like, but they are plain dewdrops clinging to a spider's web. We always talk about dew falling, but Mr Bentley says that it rises more than it falls. The earth, the plants themselves, and the air immediately around the plants, furnish the moisture that turns into dew

"The Crucifixion" was X-rayed to learn if the Dutchman Engelbrechtsen was responsible for some of its elements. It was thought that the kneeling figure in the right foreground had been added later

This is an X-ray photograph of the kneeling figure, which clearly shows that the woman's figure was painted in over that of the monk

An artist was thereupon engaged to erase the kneeling woman and restore the monk. This picture shows the figure of the monk restored. Thus are X-rays taking the place of artistic opinion

Detecting Art "Fakes" with X-Rays

No longer need we depend entirely on the guessing or intuition of the connoisseurs

THERE is so much humbuggery in determining the period to which an old painting belongs, so much that is mere opinion, that the art collector—particularly a member of the canny variety that made their money by the common-sense method of basing judgment on hard facts—will heave a sigh of relief when he learns that the scientist has at last stepped in to help him.

A scientist may know nothing of brushwork, style, "atmosphere," and the intangibles that serve the so-called art expert; but he can at least collect the facts just as he collects them when he examines a bug under a microscope or tests a piece of steel in a machine to determine its tensile strength.

Science Aids the Art Expert

About two years before the outbreak of the Great War, a German, Dr Faber, for the first time employed the X-rays to determine the authenticity of a painting. Differences in density between flesh and bone account for those X-ray photographs in which a heart is seen locked in a human breast behind ribs, or a bullet in a fleshy arm. Pigments vary similarly in density Hence the X-rays can reveal layers of paint lying below the outer surface.

An X-ray photograph of a painting resembles the original no more than an X-ray photograph of a human being resembles a personality. But it does reveal the hidden truth. It reveals, for example, the changes made by the master himself—the painting out of a hand, the modification of a landscape, the softening of a facial expression. It is just as if we had before us a play of Shakespeare's with all the corrections and interlineations that were made before perfection was attained. A forger, even if he is as conscientious as Holbein, could never hope to mimic all the subtle changes that Holbein was accustomed to make, and least of all the manner in which they were made.

With the aid of the X-rays, Dr Faber succeeded in disclosing the modifications and restorations to which a seventeenth-century "Lucretia" had been subjected, and with an accuracy that could not be attained by one of those experts who goes into a kind of trance, with his head cocked on one side, only to state after long deliberation that perhaps the painting belongs to the seventeenth century and perhaps it does not.

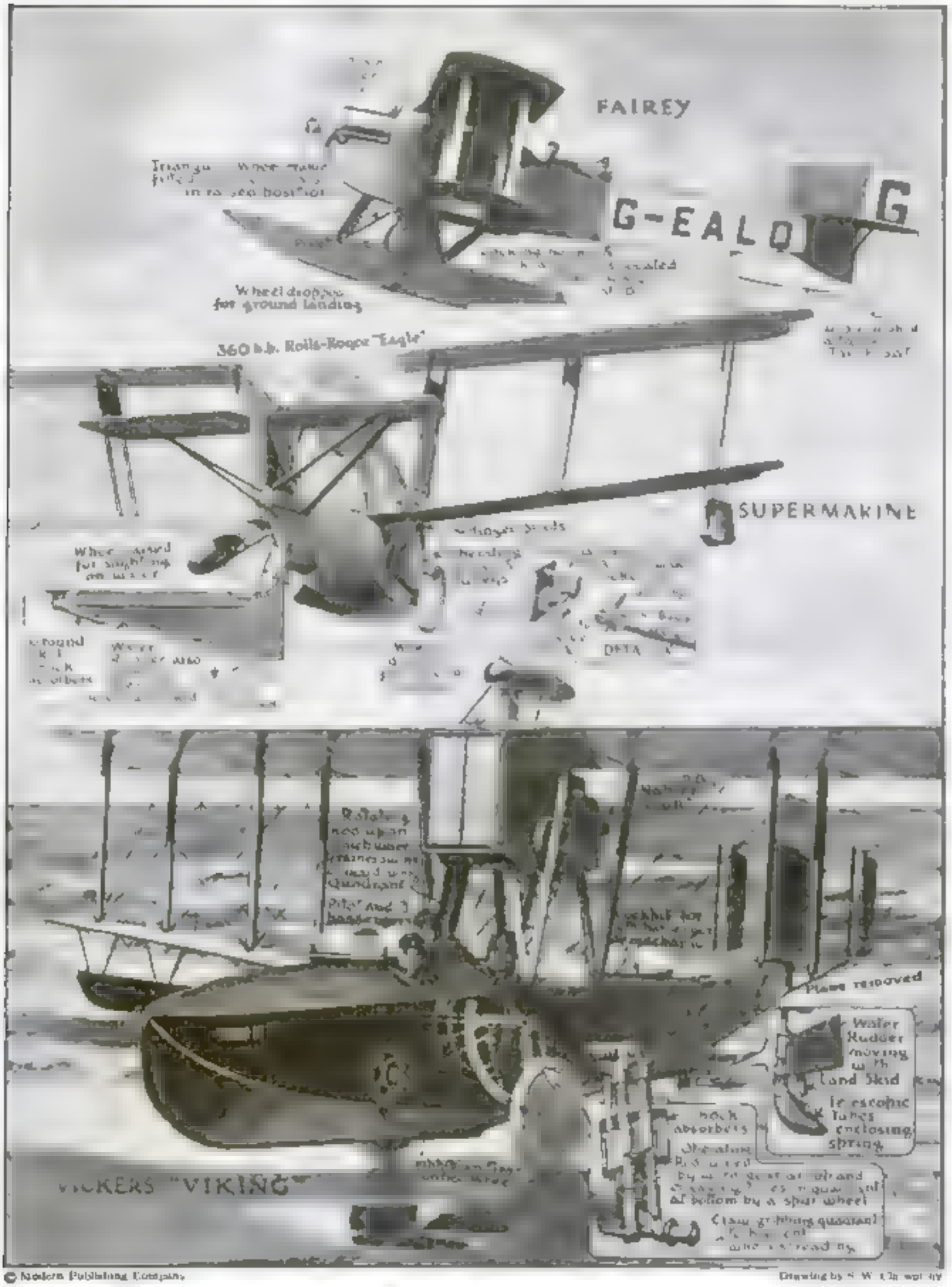
Faber's method has latterly been employed with extraordinary success in England to verify the authenticity of a painting known as "The Crucifixion," which was painted by a Dutchman, Engelbrechtsen, who died in 1533. Dr. André Chéron, of Paris, has likewise turned on the X-rays to expose what lies beneath the outer surface of a painting. One picture by Van Ostade, of men drinking at a table, when submitted to the X-ray test, proved to be a fraud.

What the X-Ray Exposes

It had been painted over a study of dead birds. Another, called "The Royal Child," a supposed sixteenth-century work, now in the Louvre, proved to have been painted during the last century over a picture of very much earlier date.

The old masters used paints that respond to the X-rays differently from those employed nowadays. The glazes of old masters, too, were different from ours; they do not react to X-rays quite in the same way as do our modern glazes.

If an art object can thus be tested as a chemist analyzes a substance whose name he does not know, the art expert will occupy a less exalted position than he now enjoys. The scientist has no preconceived notions, no prejudices. He works objectively for the truth. At best the judgment of an art connoisseur is a higher kind of guessing or intuition. By handling a painting as if it were a mysterious compound, the true nature of which is to be determined, the scientist may be able to foil a forger.



Alighting on Water or on Land

A SEAGULL draws up its feet when it flies or floats, but when it alights on land, its feet are very serviceable. Thus flying boats are equipped with wheels, so they can also run on the ground

When they drop upon the water, their wheels are drawn up and their boatlike bodies cut through the waves. But their efficiency as air-machines is hampered by the additional equipment, and "amphibeans" are as yet not equal in some respects to seaplanes or to regular land machines.

The recent British government competition for amphibians provided the first serious attempt to solve the problem of an airplane that can land upon either land or water. The three prize-winners, here shown, were the Vickers' $50 000 *Viking*, the $40,000 *Supermarine*, both boat-seaplanes, and the *Fairey*, $10,000, a float seaplane

How Will Our Ten Billion Descendants Live?

RECENTLY Professor E. M. East made this startling statement. "If the rate of increase in population existent in the United States during the nineteenth century should continue, within the span of the grandchildren of persons now living, the United States will contain more than a billion inhabitants."

There are in the world at present about seventeen hundred million people, with an annual increase of from fourteen to sixteen million. The white race is increasing much more rapidly than the yellow or the black, while China's three hundred million is virtually stationary.

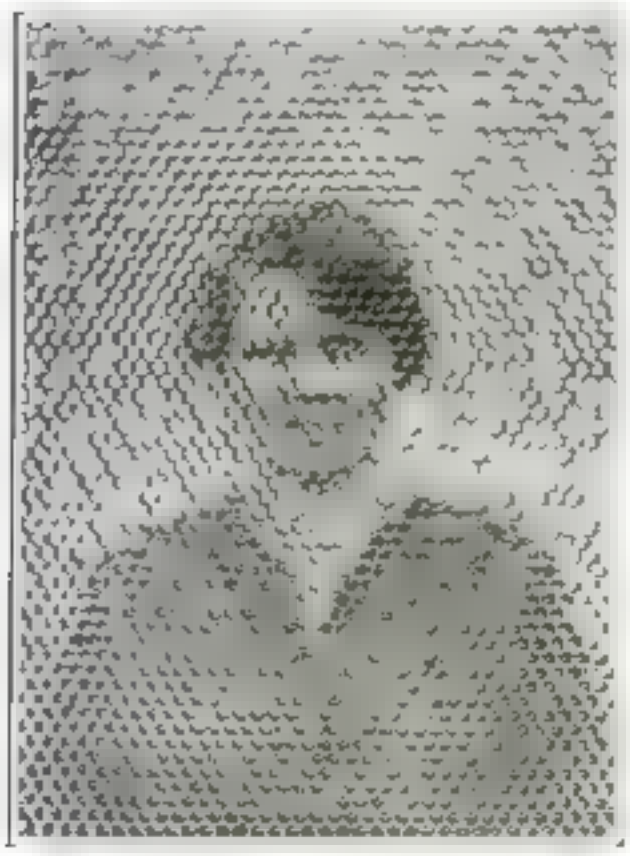
Says Professor East: "The struggle for existence in those parts of the earth at present most densely populated will be beyond the imagination of us who live in a time of plenty."

Honeycombing the Radiator of Airplanes

BELOW is shown a honeycomb type of radiator selected for cooling airplane engines of large horsepower because of its great cooling efficiency.

This efficiency is secured because the water is spread into thin sheets and made to pass between thin brass tubes, the ends of which are hexagon shaped and soldered together.

Due to the narrow water passages between the tubes, the latter have a large area exposed to the cooling currents of air through them. This large cooling area and the fact that heat is more easily extracted from a small stream of water than from a large one, give this radiator its great efficiency.



The large cooling surface of this radiator is evidenced by the ability to discern the face of the woman behind it

One man, comfortably housed in a cab that is placed on a level with the extensible boom, operates this huge hoisting and transporting crane

This Hoisting-Crane Saves Power

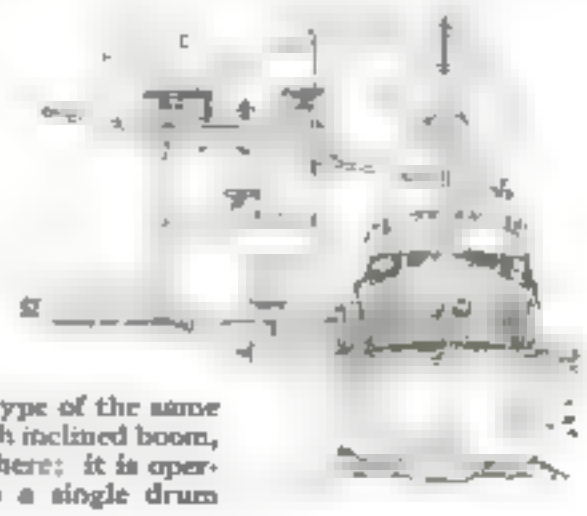
SEVERAL novel and practical features are embodied in a cargo crane and transporter recently developed by Warren Travell, an engineer in New York. It is of the counterbalanced type, uses only one drum for the vertical hoisting and the horizontal traversing of loads, requires only one operator, and may be adapted to a variety of conditions that may be found at cargo docks.

One of the most important features of this crane is that during the hoisting operation the entire weight of the bucket or skip and one half of the weight of the cargo load is balanced by a counterweight. The transporter beam, along which the load travels horizontally, is also balanced, and may be extended to suit existing conditions. When the boom is drawn in, the slack of the rope is taken up by the counterweight.

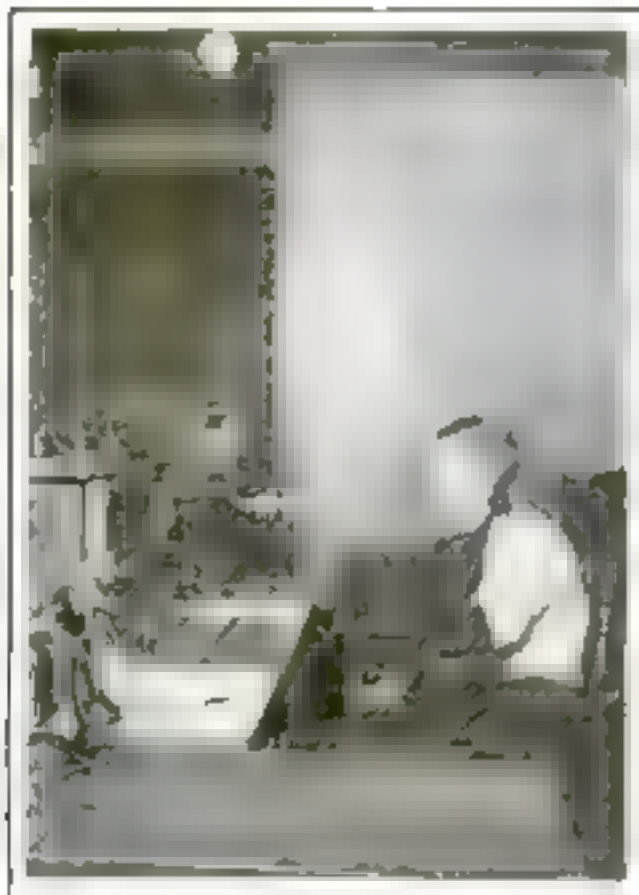
During the operation of lowering a load, the motor's power is employed to raise the counterweight.

Since the motor never has to carry the load itself, but only the shifting difference between the weight of the counterweight and the load plus the weight of the skip or bucket, the lowering is safely accomplished without the use of a brake. The hoist-drum is rigidly keyed to its shaft, and no friction clutch is required to control it.

The crane rests on legs ending in rollers, one set of which runs on a track along the water-edge of the pier, the other set on a track on the roof of the freight-shed. On these tracks the entire structure may be moved along the water-front as desired. Hatches must be provided in the roof of the shed



Another type of the same crane, with inclined boom, is shown here; it is operated with a single drum



Fire-Stations Use Maps

MINNEAPOLIS has an almost perfect fire-signal system. Beside the telephone switchboard is an electric switchboard that controls a series of lights on a map of the city. These lights show the location of all stations.

A green light represents a hose company, a red light an engine company, a white light with a black dot an auxiliary company, and a white light with black stripes a hook-and-ladder company. As these companies go out, the operator presses the control buttons and the lights flash on the map.

Company

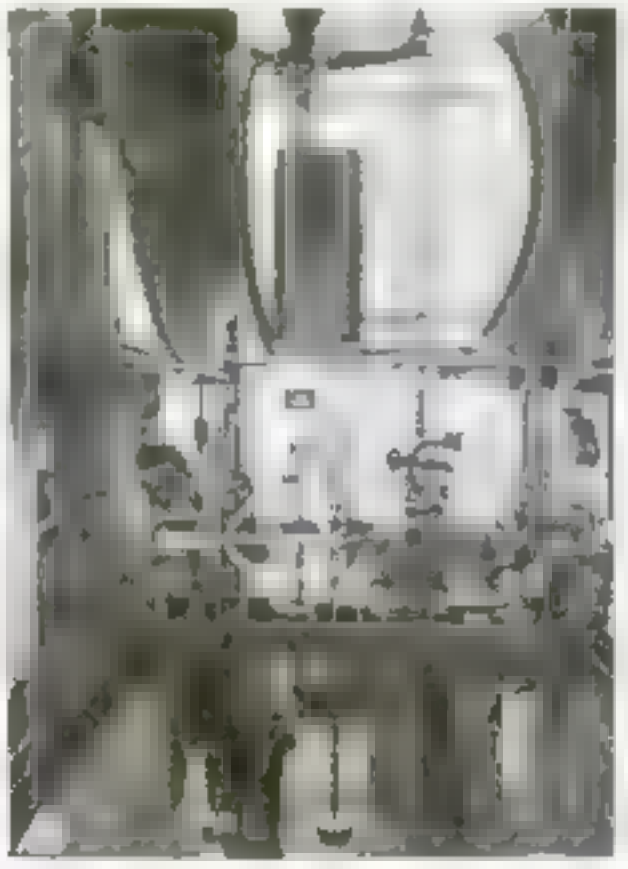
When the Chlorine-Tank Leaks

CHLORINE gas kills germs immediately. That is why the cities use it to purify drinking-water. In fact, chlorine gas has no particular regard for human beings either, since it handles them just as roughly

The first poison gas used by the Germans during the war was chlorine.

When a high-pressure liquid chlorine-tank in a city pumping-station springs a leak, great care must be exercised in repairing it. One thousandth part of chlorine in the air will cause death upon very short exposure. The gas in these big tanks is in liquid form, and a high pressure is necessary to keep it in this state. Therefore leaks are apt to occur

The little pipes leading from the tanks seen in the picture above carry the deadly gas to the water



Measuring the Wind with Scales

THIS is a balance upon which sliding or adjustable weights are used to measure the force of wind.

When the air flows parallel to the direction of flight indicated by the position of the biplane in the picture above, the pressure of air upon the models' surfaces tends to disturb its balance. This produces a wabbling effect, which is registered by the support of the model, and can be counteracted by adjustment of the weights on the aerodynamical balance. When properly adjusted, the model becomes stable in the flowing currents.

Level Shelf for Boats

IF the man who owns a motor-boat wishes a level shelf in his boat, here is a bracket that will do it

It consists of an upright piece having a pin hinge at the top to hold the strip to which the shelf is fastened. The support connecting the top of the bracket with the upright piece is in two sections, joined by a threaded boltlike member

To tilt the shelf up or down, this member is adjusted as needed

Grooved Floor-Boards for Houses

NEXT time you put down a new floor, you may so arrange the boards that the nails will be invisible. When ordinary matched lumber is used, the cracks open up through use and fill with dirt.

This new way of matching floor-boards [illegible] just mentioned. Each board has a V-shaped groove on one edge and a V-shaped tongue on the other, so the boards fit

To Purify the Swimming-Pool

PUBLIC swimming pools should be supplied with water that is constantly changing, but that remains at one temperature. This is not practical in ordinary cases, and, though we should prefer a fresh water bath, a substitute has to be employed.

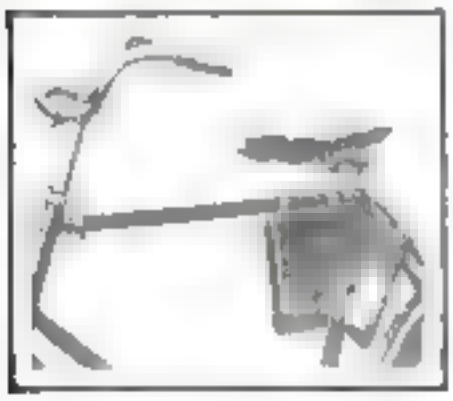
There are several systems by which this is accomplished. First, a strainer is used to remove large particles such as grit. Then it is necessary to sterilize the water. This can be done in several ways, either by exposure to the open air or by subjecting the water to the effects of ozone, and finally by the use of ultraviolet light. But it is essential that the water should also be filtered.

Shocking the Bicycle Thief

AN electrical shocking apparatus for the man who tries to steal a bicycle is going to give the thief the surprise of his life when he takes his seat and attempts to ride away. He will experience a terrific surge of current through his arms, and he will be lucky if he does not find himself sprawling on the street

A small induction coil is connected with the handle of the bicycle. When one sits on the seat, the circuit of the coil is closed and the device is thrown in operation

When the owner of the bicycle wishes to ride, he opens the box containing the coil and breaks the circuit with a small switch. If he is absent-minded and forgets to do this, he will be reminded of the fact in no gentle manner when he attempts to ride off



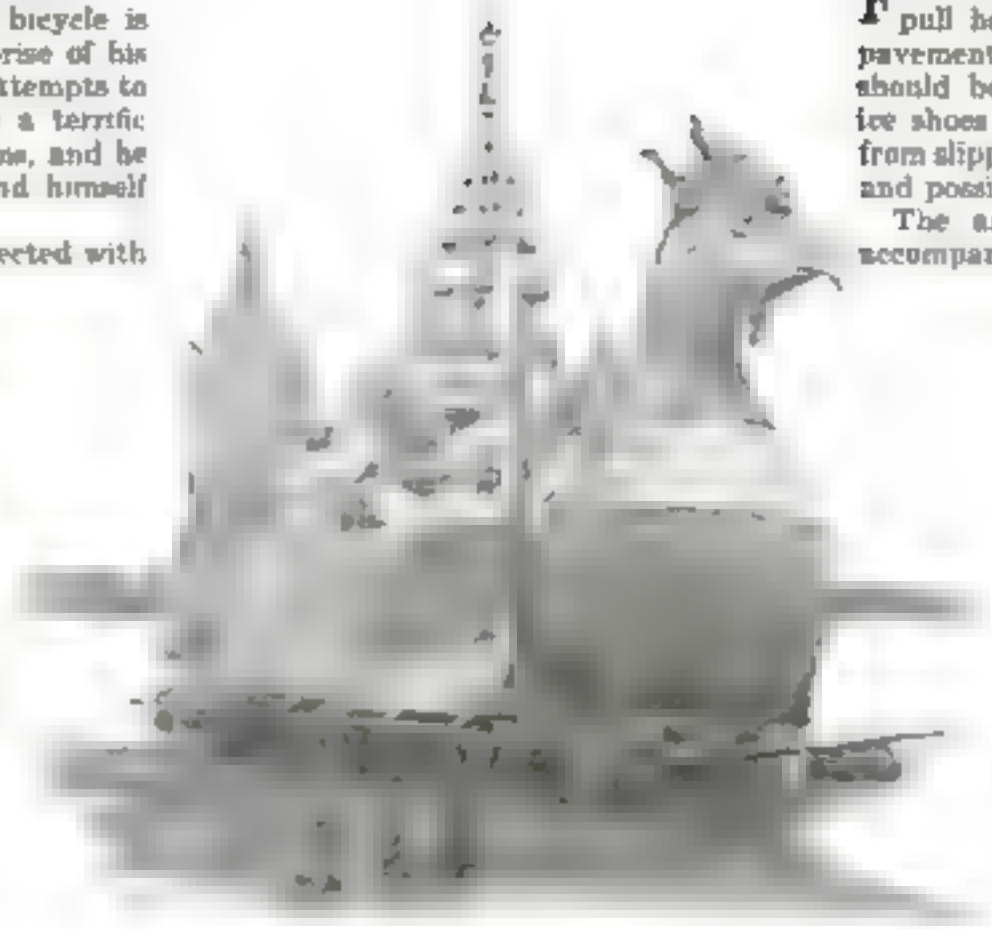
Belleau Wood in Plaster

BELLEAU WOOD, in France, will forever remain in the memory of the United States

The plaster-of-paris map shown below was made to keep the memory of this great battle alive and to enable army students of the future to study the military features of that famous engagement of the great war

The details of the landscape are placed over the plaster of paris, which is first molded to correspond geographically with the actual locality in France.

By the use of paint, sponge for trees, and bits of wood and cement, the landscape artists brought into being this beautiful reproduction, which is so faithfully executed that it looks like a photograph taken from an airplane.



One of Burma's Religious Customs

THE Burmese are fond of pagodas, by the erection of which they think they gain great merit, counting toward peace in the next world. They are also like children, fond of a joke, so they build their pagodas of queer and fantastic shapes. The framework is usually of bamboo covered with gold and silver paper, and the erections are often put on rafts, supported by barrels, and floated in rivers or lakes

The illustration shows a particularly gorgeous paper pagoda, intended to represent a curious kind of hen, floating on the lake at Meiktila, in upper Burma.

Cook Pork Thoroughly

NO matter how healthy the animal, uncooked pork probably contains live trichinæ. Pork products that are prepared in establishments operated under federal supervision are subjected to processes that destroy the parasite.

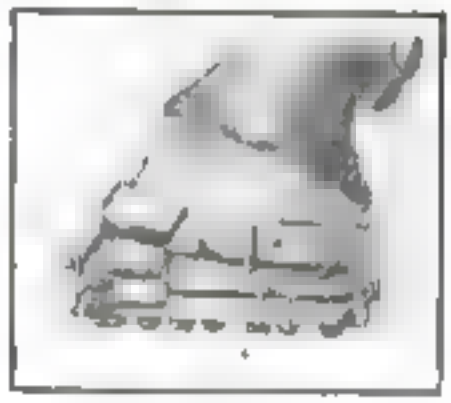
In the home the same end can be attained by making sure that the meat is thoroughly cooked, when it is more or less white in aspect, even at the center of the piece.

Keep Your Horses from Slipping

FOR humane reasons, horses employed to pull heavy trucks over the ice-covered pavements of city streets in the winter should be equipped with properly fitting ice shoes or creepers that will keep them from slipping and protect them from falling and possible injury.

The anti-slipping shoe shown in the accompanying illustration is a French invention. It consists of a steel plate shaped to fit the hoof, and provided with rivets, the heads of which prevent the horse from slipping. The steel plates are padded and are attached to the hoofs by hinged clasps and buckle-straps of leather

The creepers are easily removed when not needed and do not materially injure the road surface, even when they are used on a thin sheet of ice covering



He Keeps His Car in a Tree

GARAGES don't grow—they are built. Yet there is one garage, located near Santa Cruz, California, that was made absolutely by nature. It will accommodate one large car.

How did it happen? About a thousand years ago a tree started to grow. It continued to grow on through the centuries, and, at some remote date, caught fire. The fire consumed a large part of the tree-trunk, and, when it died out, left a great hole in the bottom of the trunk

The man who owns the property on which the tree stands now stores his car in the tree

This garage has one advantage that a number of other garages lack—it is in entire accord with the surrounding landscape.

Horses Live in this Hotel

"DOBBINS in room 402" says the hotel clerk to the manager

What's he doing there" you wonder; for "Dobbin" is certainly the name of a horse and horses are not usually found in hotel rooms. But the hotel in question is a horse hotel -all four floors are divided into stall like rooms, and there is a long, sloping runway at the back. The horses use this runway in going to and from their rooms

What a the idea of it? The man who owns the hotel owns the horses, and also owns several carriages. He believes, wisely, that if he treats his horses well they will look well when hitched up. He does a thriving livery business in Berlin.

Certified Water

MILK is "certified," which means that it can be drunk without danger of contracting typhoid. Why not certify water? After all, water is more freely drunk than milk and is more likely to be contaminated. Accordingly, the Public Health Service cooperates with the different State boards of health to test the water used on railway-trains and boats for drinking and for cooking.

This will tend to curb the severe outbreaks of typhoid fever that originate in ships and railway trains.

A Burn Can Be Dressed with Egg-Skin

NOT only is an egg one of the most valuable foods in the sickroom, but, like many patent medicines, less worthy, but more widely advertised, it can be applied externally as well as taken internally

Reliable medical authorities have recommended the thin skin of an egg as an excellent dressing for burns and cuts. The thin film that is just inside of the shell is already sterile if one's hands do not touch its inner surface before applying it to the wound.

The skin adheres to the wound itself, and not only does it keep out the air, but it accelerates contraction and quickens the process of healing.

Try it the next time you need to dress a burn, and you will find how well it works.

Up Goes the "Drawbridge"

HERE is an unusual bridge that lifts itself in the air when it is necessary for a boat with high masts to pass underneath it

A powerful lifting-boat is located at the top of the bridge. A cable passes through the center of each of the steel posts. The bridge is lifted from all the four corners to the top of the structure, exactly as an elevator rises. When in this position traffic may pass without hindrance the bridge drops back into place

Where do you think this typically modern bridge is to be found? You will be surprised to learn that it is in the city of Manila, Philippine Islands

Protecting a City with Dummies

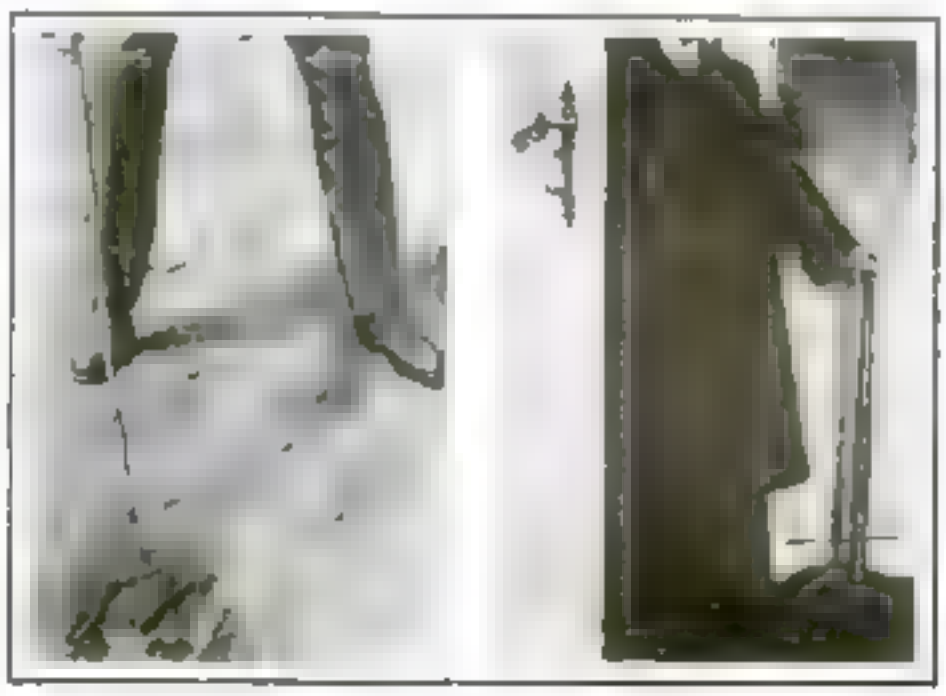
A CURIOUS fact has just come to light concerning a plan to protect Paris from air raids during the last days of the war A complete imitation of the Gare d'Est, with about two miles of railway lines, signals, sheds, and trains, was constructed about fifteen miles from the French capital. Translucent canvas, with dummy trains, was laid on the ground, and the steam and smoke of factories was imitated. Searchlights and half-hidden lamps formed the night illumination of the imitation city of Paris.

Ten Million Years Old Is this Footprint

TEN million years ago a great dinosaur, weighing many tons, trod on this spot. The spot was soft clay at the time, but as the centuries rolled by the clay became hard and stone-like.

The impression to-day is nearly as distinct as the day it was made, millions of years ago. The two great toes of the beast left clear-cut marks, which may be seen in the photograph.

These footprints were recently discovered in Connecticut, and scientists attach great importance to the find. The footprint shown in this picture is not the only one, but it was the best preserved.



You Are Met at the Door by this Mud Brush

WITH all his faults, the average German is certainly very neat. And his wife is properly called a *Hausfrau*. She spends all her time in the various branches of keeping house. Dirt and dust and mud are her enemies.

In many German homes today you will find a long-handled brush, like the one at the left, standing just inside the front door The brush is shaped like a mound, and the bristles radiate from the center

What's it used for? Cleaning shoes before entering the house. Its shape enables the user to remove mud from any part of the shoe.

"Camera!" Shouts the Director

AT last a way has been devised to allow a motion-picture director to conduct a large scene without shouting at the top of his voice.

The loud-speaking telephone is the instrument that has made this possible. Although it is not a new invention, it is only recently that this device has been used to carry a director's voice to a large group of players on location.

The director speaks into a mouthpiece, and his voice, many times magnified, comes from a horn. The instrument, both in appearance and working principle, is a cross between a telephone and a phonograph.

The Prophet's Traveling Tent

BENEATH a canopy of gorgeous Oriental rugs that protect him from the sun, the prophet of Mohammed moves across the desert. In this sacred seclusion he prays with much ceremony until the time arrives for him to step out before the multitude.

Four thousand years ago temple altars were oriented to the rays of the splendid Sirius and other stars. But today the gods are no longer in evidence except in the temple ruins. In their place the modern religions hold sway, and every sunrise and sunset sees the long-robed Arabs kneeling toward Mecca, bending low in prayer.

How Big Bells Are Tuned

CERTAINLY this will look like a queer tuning-machine to you. But a tuning-machine it is, nevertheless. It is used only in tuning large bronze bells. In this case, it is tuning one of the bells to be used on the Royal Exchange in London, England.

The bell is mounted on a boring-mill to have some of the metal on the inside turned off. A boring-mill is a vertical lathe for metal turning. As the metal is cut away from the interior of the bell, its tone will be changed.

The cutting is continued until the bell possesses just the tone desired by its makers.

Keeping "Tabs" on School Classes

THIS class record-board looks like a mosaic floor at first glance. It is in use at the Massachusetts Institute of Technology to keep a record of the use of the one hundred class-rooms and auditoriums.

Each class-room is given a number and a slot. When this or that class-room is in use, a small card is placed in the corresponding slot on the record-board. This will tell at a glance just where every student body is at any time of the day.

The exact location of any student in the institute is also known, a precaution taken in the event of an emergency.

Coffee-Drinkers on the Increase

OVER $300,000,000 worth of coffee was imported into the United States last year, according to the statement issued by the National City Bank of New York City.

As the preparation of this material for the market, including roasting, freight, and distribution, must be added, the total valuation amounts to about $365,000,000.

Maybe prohibition is responsible for the increase in coffee-drinkers. At any rate, they drink $1,000,000 worth a day.

Shaken Up in a "Movie" Box

INTO an empty box on the station platform jump the frightened bride and groom. The bride's furious father appears.

The baggage-men bounce the box down the platform. Of course, you are sure the bride and groom are not in the box when this is done, yet a close-up shows them whirling in it.

The picture below shows how this kind of close-up is taken. The box, with the bride and groom wedged in it, is placed in a cylindrical case. The case rests on rollers. Both background and case are black. The case turns smoothly on the rollers.

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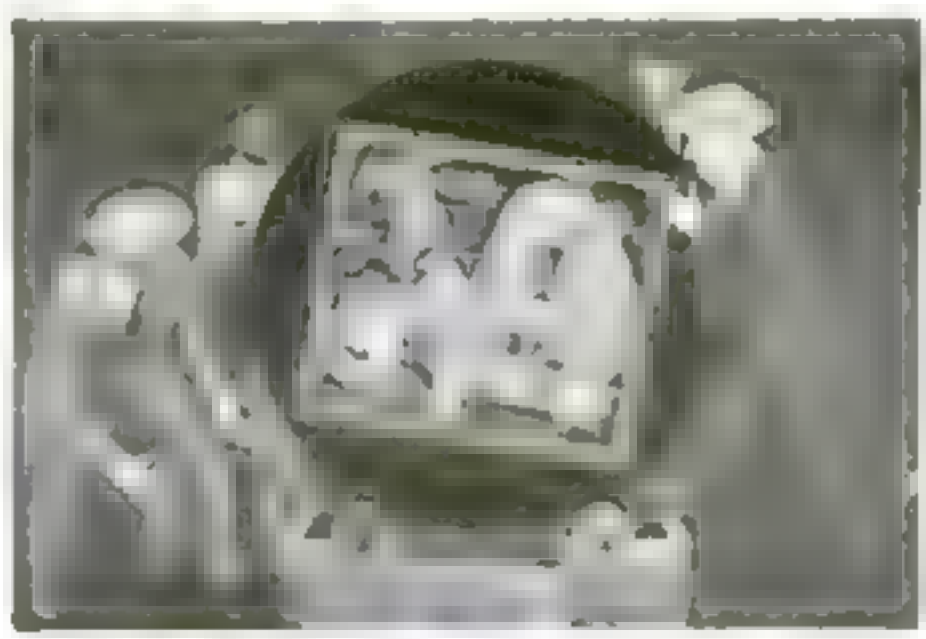


Longer Life for Shoes

METAL tips and heel plates will prolong the life of a pair of shoes, but at the same time they will scrape all the varnish off the floors on which they travel.

How can this shoe problem be settled satisfactorily?

The steel disk shown on the shoe in the picture above is one solution. It is countersunk in the tip of the shoe, and consequently does not strike the floor before the surrounding leather.

Cooking the Meat for the Animals in the Zoo

EAT meat but once a day—that's what the doctor tells you. This schedule is followed in zoos, and the amount of illness among the animals is usually surprisingly low; undoubtedly the fact that they are not allowed to eat meat more than once a day accounts to some extent for their general good health

The four-footed animals are given plenty of vegetables and bread—in fact, they eat the same kind of food that we eat, but in greater quantity, of course

In the picture above you see one of the large modern ovens now in use in Bronx park—New York's mammoth zoo. Huge pieces of chuck are broiled every day and fed to the smaller animals. Monkeys and bears like their meat cooked, while all the members of the cat family—lions and tigers, for example—like their meat red and raw

The very old and the very young animals are given the more tender parts of the meat, however, meat is so expensive nowadays that only the cheaper cuts can be bought and therefore not much discrimination can be shown

Casing the Cigarette-Holder

NOT so long ago silver chatelaines were very popular among the women. From them hung anything small and silver. The same thing is now happening to men's watch-chains. And one of the latest hangers-on is the cigarette-holder case shown above.

The case is small and golden; the cigarette-holder is collapsible and fits snugly inside the case. When you are not smoking, you wear the case on your watch-chain

Pellagra's Relation to Poverty

CONCLUDING a three-year study in cotton-mill districts of South Carolina, the U. S. Public Health Service has come to the conclusion that the prevalence of pellagra varies inversely with the family income. This is the first reported confirmation of the suspected relation between poverty and pellagra. As the income falls the disease affects more of the family with higher incomes it affects fewer.

A One-Truck Train

HERE'S a whole railroad train, "Train Number One," on the Elkin and Alleghany Railway, which isn't a train at all, but just a Ford truck equipped with flanged wheels, enclosed body, and trailer, the latter serving as the baggage-car

This improvised passenger-coach operates over a roadbed at the foot of the Blue Ridge mountains, for a distance of sixteen and one half miles. The car seats nineteen passengers and a driver

On one of "Number One's" trips last winter, running over a wet track, it carried twenty-nine passengers, 1187 pounds of mail, and 940 pounds of express totaling, approximately, 6150 pounds up a two and one half per cent grade on high speed.

Sawmill Waste as Boiler Fuel

MILLIONS of tons of sawdust are thrown away in this country yearly. It is only recently that serious efforts have been made to use this material. Sawdust burns slowly, with a fair production of heat, and produces little ash.

A number of sawmills throughout the country are attempting to get rid of this waste material by using it in place of coal as far as possible.

Threshing Planks into Shreds

"THRESHING-MACHINE" was the sign outside of one of the lots at a county fair. Yet the men within were feeding the machine heavy oak planks! All the farmers gathered around

That was exactly what the exhibitors wanted. They wished to demonstrate to possible users the strength of the thresher teeth.

The planks were fed into one end of the machine and came out in shreds at the other end

Welding as It Revolves

"DO it by welding" seems to be the modern idea. The commercial application of gas and electric welding is growing fast, indeed. Manufacturers are employing this system more and more. Where the noise of the riveting hammer used to be heard, the hissing of the electric arc or gas flame is now evident. Welding speeds up production. Here is an electric welder for welding steel barrel heads in place It welds as the barrel turns. Three electrodes come in contact with the barrel head so that the barrel only turns one third of a revolution. The high-amperage transformer which furnishes the heavy current is placed at the top of the machine.

How Miners Charge Their Lamp Batteries

MANY of the miners' oil-burning lamps have given way to the safe electric light supplied with current by a small storage battery. When the miner starts out on his day's work, he takes with him a freshly charged battery

The charging of these batteries used to be a haphazard matter, but, like everything else, it has been systematized. A new charging-rack did the trick.

When the miner comes up to the surface after his day's work, he places his battery in the rack under a certain number. When the battery is slipped in place, it is automatically connected with a charging circuit. The miner returns the next morning and finds his battery fully charged and ready for another day's work.

When Lying Hurts the Liar

THE most misunderstood form of lying is that known as "mythomania." In it the person who tells the falsehood does so without purpose, and sometimes with injury to himself It develops from the fable-making of childhood, and, unless corrected early, will work great harm in one's life.

There have been cases of mythomania in adults that have baffled the best detectives. The victim has told things about himself that might be highly incriminating, and when questioned made use of his quick presence of mind to strengthen the circumstantial evidence against himself

This mental disease often works harm upon others who are as innocent as the mythomaniac himself, though he is as prone to tell flattering lies of himself.

Closing Bags by Machinery

BECAUSE one machine can close as many large bags of sugar, feed, seed rice, etc., as can be sewn by four men, bag-closing machines are rapidly taking their rightful place. The portable, electrically driven bag-closing machine shown in the accompanying illustration is a recent development. Besides being quicker than hand labor, the machine does the work cheaper and better

The better work performed by the machine as compared with hand methods, is secured by sewing the mouth of the bags with eight stitches to the inch instead of three or four as by hand. This close stitching has saved thousands of dollars.

It Takes the Place of Thirty Men

MANNED by a crew of three, this motor-crane is capable of setting more telegraph-poles than could be handled by three gangs of men. Similar economies are realized by using the motor-crane equipped with a clamshell bucket for unloading bulk material from freight-cars

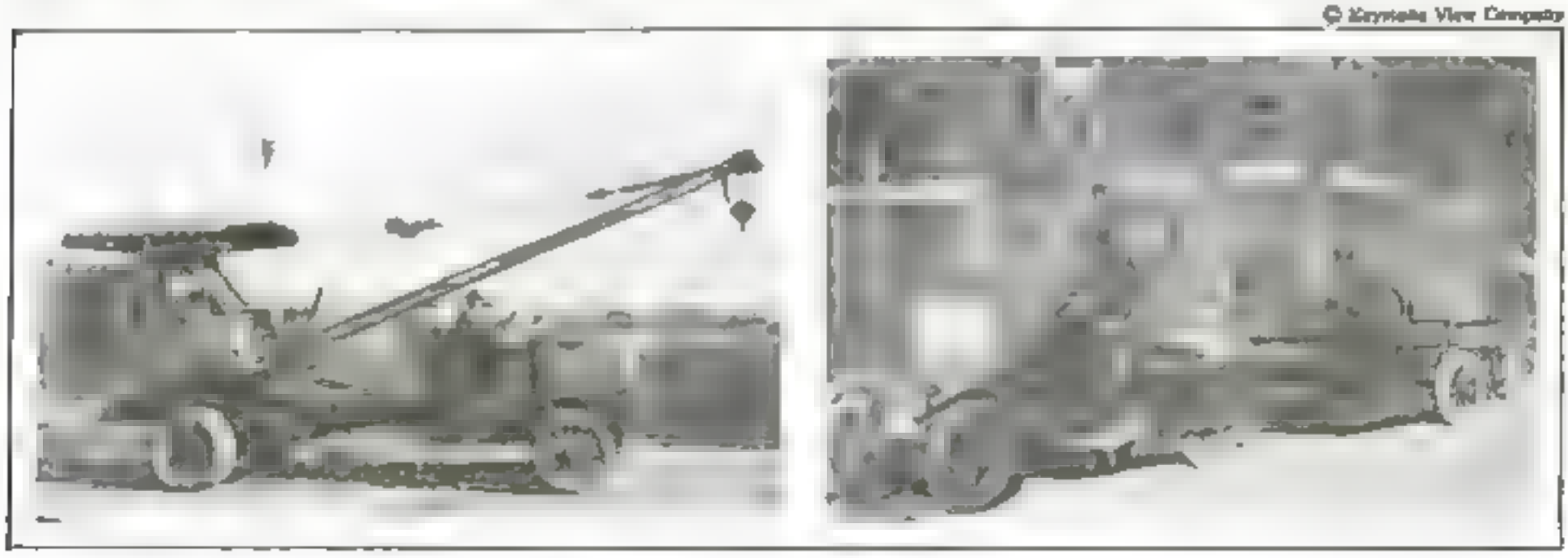
The crane is a full-swinging, self-contained type, rotating through 360 degrees, and is driven by a separate four-cylinder gasoline motor that is built with an extra large flywheel so as to run smoothly in spite of sudden application and release of loads. The capacity of the crane is eight thousand pounds, and its particular advantage is that it moves rapidly

First Aid to Horses

WHEN Dobbin falls in a hole or drops over an embankment, a hurry-up call is put in for the horse ambulance and derrick-car shown below. Ropes are thrown around the body of the animal, and it is hoisted up to the ambulance trailer and carted away to its stall or to a horse hospital

The derrick, although operated by hand with the aid of a small winch, is easily capable of lifting a heavy truck-horse. Any tool that may be needed in extricating the animal is carried on a board at the side of the motor-truck.

It will be noticed that the ambulance trailer is a two-wheeled model



Every Dog Has His Day—Sometimes in the Hospital

An elaborate veterinary college for pets is maintained in Berlin

This hen moped around the yard. She was taken to the Berlin Veterinary College and two experts looked her over thoroughly

Here you see a puny pig that will never become pork unless it can be treated [illegible] What [illegible] has in [illegible] a matter [illegible] ture

A [illegible]

T[illegible]

Fourteen of them—all waiting for the doctor to treat their ailing pets. Dogs, cats, hens, and pigs are the most frequent patients, and they all receive the best of care

How Would You Meet These Tests?

Discovering what particular job in the world you are best fitted for

The housesmith who rivets and fits steel beams on the frame of a skyscraper must be steady on his feet Stand on one foot and test your steadiness. It is not easy You sway after a time. It was thought a few years ago that such tests, conducted in a laboratory, would reveal a man's fitness to hold a certain job. Psychologists now find that the problem is not so easily solved

"Am I musical?" you ask. The psychologist has found that there are at least eighty factors that determine musical talent. One investigator has fixed five of these eighty factors. They include acuteness of hearing, appreciation of pitch, time, etc By listening to a metronome as this boy is doing,, the sense of rhythm can be tested

On the table is a metronome a time beater The seated man taps with a lead-pencil in time with the ticking metronome. The examiner, watch in hand, notes how accurately the subject taps. Thus muscular control of a certain kind is tested

Can you touch the bull's-eye with a pencil? This is called the "aiming test" It doesn't follow that a man who can't touch the bull's-eye every time is so defective that he cannot fill a specified job. The test may prove him only 62 per cent proficient, but in his work his percentage may be 100

Something is missing in the objects pictured. It is a test of attention, alertness, and analytical ability to discover what is wrong in a given time. A man who fails in the test would not make a good locomotive engineer, detective, botanist, or druggist, he could not fill a job requiring accurate observation

Radio now comes to the aid of the business man. This progressive German broker has found a new use for it

Brokers Find a Use for Radio

A NEW use has been found for radio. Up-to-date brokers are now using small radio outfits to keep their clients informed regarding market fluctuations.

A small but powerful transmitter is installed in the broker's office, and his clients are provided with a sensitive receiver. The aerial used is of the "loop" type, and it is so small that it may be placed on the desk in the office. The stock reports are sent out at regular intervals by the radio "ticker." Such installation is inexpensive and costs very little to operate. It is fairly safe to assume that this method of communication will soon become universal.

No Disturbing Noises

DID you ever try to carry on a telephone conversation when the wires were sizzling and crackling? "Hello!" *snap, crack*—"Hello? Yes, as I—" *Bang!*

A new telephone has been developed that is immune from the ordinary disturbances that make hearing difficult. The diaphragm—that little disk of thin metal that receives the sound impulses produced by the voice—is so arranged in the transmitter that any disturbing noises will strike both sides simultaneously.

If both sides of the diaphragm are struck at the same instant, with equal force, no effect will be produced, and the diaphragm will not vibrate. The sound impulses from the voice strike the diaphragm from one side only, and they are impressed upon the circuit. This instrument will operate without interference in a room with several aviation engines going. This will make it of great value for intercommunication on airplanes and large vessels, where the roar of the engines is so loud.

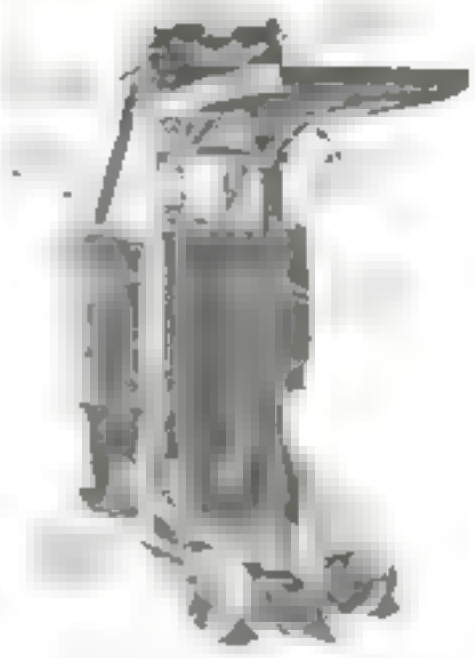
Conversation may be heard over the telephone with a number of Liberty motors operating in the same room

The Truck with Almost Human Arms

BECAUSE it will mechanically load and unload wagons, motor-trucks, or freight-cars, and pile or tier the material in stock-rooms where cranes are not available, the new industrial truck here shown appears to have almost human arms. To be sure, these arms are made of metal, and are much stronger than human arms, since they will lift a maximum of two tons from twelve to seventy-six inches from the floor or ground without rehandling. But, even more than that, the truck will carry the goods from the point at which they are unloaded to the point where they are to be stored, and will place the separate pieces of the load one on top of the other—all without being lifted or moved by a human hand.

Because this work is done mechanically instead of manually, much time is saved, and the same work can be done with fewer men—both important factors. Because the machine is capable of tiering the goods carried, either directly on top of a pile or on platforms, much valuable floor space may be saved through making higher piles. Unlike human arms, however, those of the machine do not become fatigued as the day proceeds, so that none of their efficiency is lost. The apparatus is really a combination electric industrial truck and a tiering machine. It consists of a small four-wheeled framework on which is mounted a storage battery and a vertical elevator.

A combination truck and tiering machine consisting of a four wheeled framework on which is mounted a storage battery and a vertical elevator



The platform is operated by a motor. Goods can be raised to a motor-truck or stored on floors where cranes are not available

The powerful lifting arms are in the form of a horizontal platform that is raised and lowered by a separate motor placed on top of the vertical framework. The maximum load of four thousand pounds may be lifted at the rate of one foot in eighteen seconds. This is equivalent to raising the load forty-two inches from the floor in forty-six and one half seconds, or seventy-six inches in one minute thirty-seven and one half seconds. This speedy elevation has been made possible by the development of a new worm and worm-wheel drive between the motor and the lifting framework.

Because all four of the rubber-tired wheels are made to steer, the truck, one hundred and twenty-one inches in length over all, turns in a radius of ninety-two inches, or less than its own length. The storage battery is placed above the frame at the rear, and covered with a metal box

Luring the Wily Trout

Outside of business hours Leo H. Vaughan spends all his time practising the science of dry-fly tying

By Raymonde G. Doyle

THROUGHOUT the New York export district, where he attends to business six days a week, Leo H. Vaughan, representative of a rubber manufacturing company, is known as a man who has the art of salesmanship at his finger-tips. There are those who never would suspect he does anything else but sell rubber.

But there is another side to this salesman. His friends like to see him coming. They know he will steer them along the lane to an order for rubber goods, but they grin in a satisfied sort of way at the recollection that Mr. Vaughan is an expert angler and that—well, maybe he will go up to the club for dinner and whisper some of the secrets of dry-fly tying, and even tie one or two for their edification.

He is a practical entomologist, expert trout-angler, and past master at tying flies.

Practical entomologist? Trout-angler? Dry-fly tyer? A strange combination! But to be a really expert trout-angler, Mr. Vaughan holds, one must first be an entomologist. After that he must be able to tie dry flies—imitations of the winged and unwinged insects that the fishes feed on.

Five years ago, Mr. Vaughan became dissatisfied with the commercial dry fly. Most of them came from England, and he suspected that the British manufacturers gave considerable attention to their local flies to the neglect of the American varieties. So he hiked out to the country, and spent days and weeks studying flying and crawling insects. He used binoculars on the winged creatures to see how they alighted on the water. He brought back to his home in Brooklyn large collections of live bugs and studied them further.

The Vaughan home now has a workroom where the rubber salesman can throw aside his business clothes and sit down at a bench and a small table provided with an odd assortment of tools, among them a watchmakers' vise, a microscope, a tumbler with a mirror for a bottom, tiny forceps and tinier scissors, wax, and varnish. Boxes on shelves near by contain quantities of feathers of the American wood duck and the Chinese mandarin duck, both now on the "thou shalt not kill" list; hanks of peacock herl, the outgrowth on the breast of the bird; feathers from the commoner birds, spools of vari-colored silk and wool and cotton thread, and boxes of small fish-hooks.

A fisherman ever since he could bend a pin, and a dry-fly fisherman since he discovered the fascination of the art, Leo H. Vaughan, a New York rubber salesman, spends all his leisure imitating the winged and unwinged insects that fishes feed on

On the table in his workroom are all manner of curious tools—a watchmakers' vise, a tumbler with a mirror at the bottom, feathers of the American wood duck and the Chinese mandarin duck, besides tiny scissors, forceps, and a microscope

At fly-tying Mr. Vaughan works swiftly. He places one of the hooks in the vise, its shank horizontal and the point where it can do no harm. Next he fills the mirror-bottomed tumbler with clear water, and places one of the live insects that he is to imitate in feathers and silk on the surface. The mirror reflects the under side of the insect—the side the fish sees when he is searching for food. Great care must be taken to imitate the under side faithfully, is one of Mr. Vaughan's discoveries. He examines his model with the aid of the microscope.

His fingers deftly twist a bit of thread around the steel shank. He has selected a color that shows in the insect reflected in the tumbler, and as he works the body quickly takes shape. The natural bug may boast a rib or two of gold or silver, and these are imitated with fine wire. Then the wings—delicate bits of feather from one of the boxes—are selected and fastened to the body with a few turns of thread. The legs are formed from the hackle feathers of certain birds.

They are selected for color and texture, and as they must keep the fly afloat, they must be more numerous than those of the live insect. The thread is knotted tightly at the head end of the fly and a drop of varnish is placed on the knot. The thread was waxed before the job was begun.

Mr Vaughan's fingers now smooth back the wings or lift them to a saucy angle, according to the position of those on the model. The legs are clipped to the correct length and the job is finished.

The fly that has been turned out ready to be fastened to a gut leader and cast over a favorite pool may be an imitation of the May fly—the white miller, as it is listed by anglers; it may be a black gnat, or the white miller's little sister, the white moth. Whatever it is, it is an impudent-looking mite that could be a museum piece instead of a trout lure.

A triplane glider in flight with Richter-Hauenstein, of Berlin, as pilot. Great efforts are at present being made in the direction of motorless gliders and lower-power airplanes

Many a mishap attends the engineless airplane. Lilienthal was killed in making a glide and so was von Loessl, recently. This is Drude's machine after a landing

Eagles and vultures have been observed to fly without the slightest apparent motion of their outspread wings. Clearly, they know how to use the fluctuations in air currents. Can man do the same? Must he always fly with the aid of engines that generate from fifty to two hundred horsepower?

The problem of engineless flight has been attacked by a few bold experimenters in Germany. Like Lilienthal of old, they use what are known as gliders—machines built like airplanes, but engineless. A man runs with the machine down hill or gets a start in some other way

Here is a monoplane without an engine. The pilot runs down a hill or leaps off the edge of a precipice and then glides until the machine slowly drops

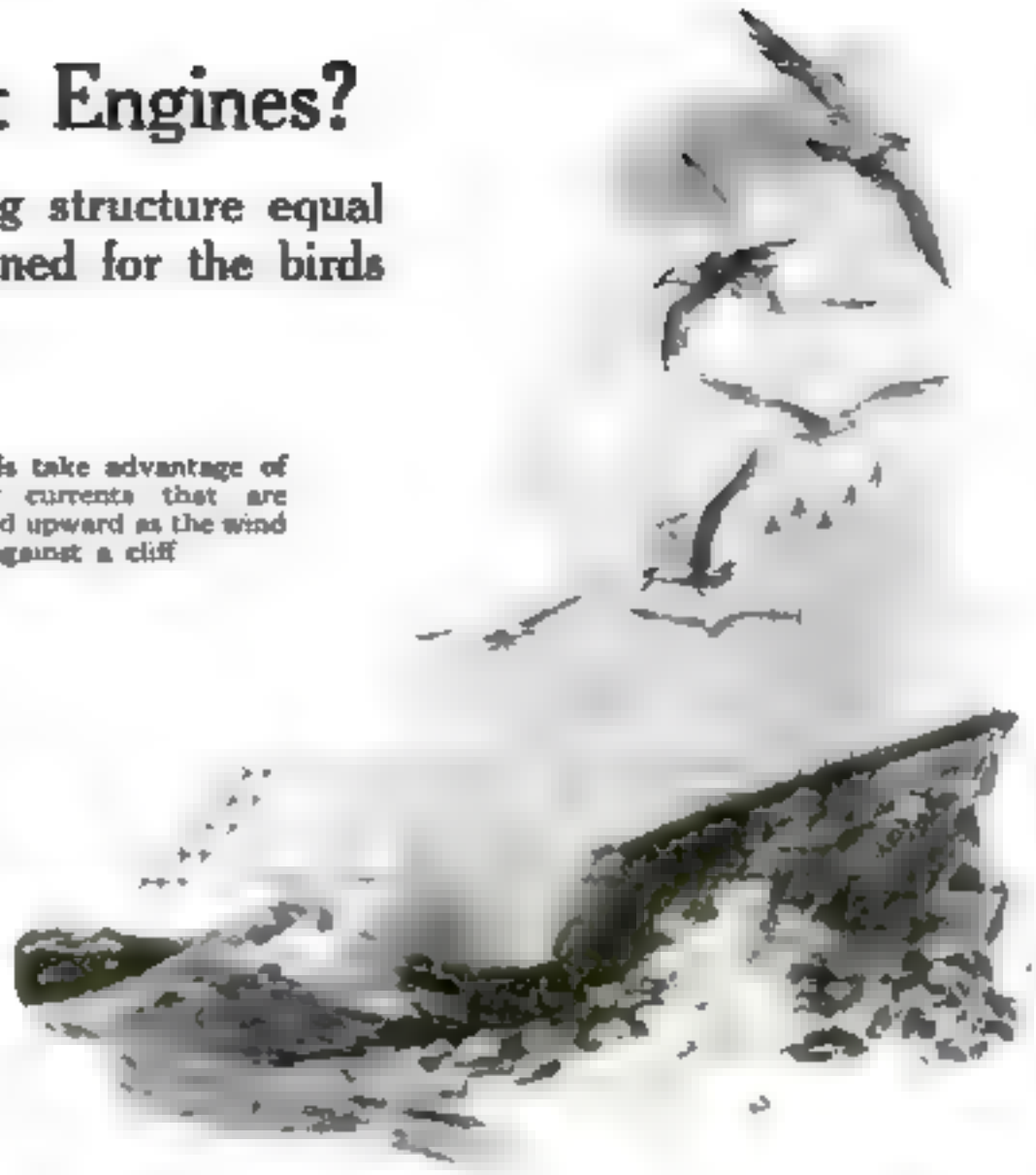
Some of the gliders in a contest held in Germany were very beautiful. In the air they were as graceful as birds. This shows Nessenann in a Zeise machine

April, 1921

Can We Fly without Engines?

Only when we can produce a wing structure equal to the one that nature has designed for the birds

By C. A. Oldroyd



Sea-gulls take advantage of the air currents that are deflected upward as the wind blows against a cliff

SHALL we ever be able to sail through the air like the birds, sustaining ourselves by the power of our hands and feet? Not unless we can produce a wing equal or even superior to the wonderfully designed wing that nature gave to the birds, which is far more efficient than the stiff, rigid surfaces of our airplanes.

To alter the tilt, or the "angle of inclination," as the aeronautical engineer says, of an airplane wing, the pilot has to incline the whole machine. The bird alters only the tension in a few muscles, the position of a few bones, and gently the whole of the wonderfully flexible wing warps accordingly, increasing or decreasing the angle of inclination.

If less span is required, the wing muscles are tensed, the span decreased, a sudden gust can not harm the bird's wing; it can, at the most, change the inclination a little. As soon as the pressure becomes too great, the wing flexes and lets the wind pass harmlessly.

But if we cannot fly like the birds, we can at least glide just as they do, if only for short distances. In this we are greatly helped by the disturbances in the air. These are always present, even if our senses are not fine enough to detect them.

You will have observed gulls soaring, for instance, preferably near a sea-wall or near any obstruction that might deflect the air current. The wind rushes over the surface of the sea, and suddenly hits the sea-wall. The direction is immediately changed, and at this point the wind blows upward. The gulls have found that out long ago, long before the scientists wrote lengthy volumes on "natural flight"; and they soar upon this vertical current, enjoying themselves hugely, diving down to the surface of the sea when a particularly tempting fish becomes visible.

How can we do likewise? We watch an albatross following a ship for hours and for days, seemingly without exertion, only flapping its wings occasionally.

By building a very light, airplanelike wing system, we can cover very respectable distances by gliding from an elevated point—the top of a hill, for instance; but we can not yet sail, like the albatross, for hours on end.

The inventors of the airplane, the brothers Wright, were expert gliders before they installed an engine in their biplane-glider, and they carried out hundreds of glides. As soon as the airplane developed, more speed was demanded, and yet more speed. Heavier wings and sturdier fuselages were required to lift and support the more powerful engines; more fuel had to be carried, until, at the end of the war, we had the most uneconomical type of airplane, equipped with a three-hundred-horsepower engine and lifting just one pilot.

This was the fighting plane, which loops and stunts, spitting machine-gun fire from the air. Its safety lay in its speed. It was equally difficult to hit from the ground and from another swiftly moving airplane.

Peace time demands a different machine, an airplane that will carry a great weight with great safety at a moderate speed. Some aeronautical engineers have gone back to the glider to study gliding first and low-power flight afterward. Great efforts are being made in Germany to bring out an efficient glider and later a low-power airplane, as gasoline is very dear and the supply uncertain. A meeting of glider constructors was held at the "Wasserkuppe," a hill that offers great opportunities for long-distance gliding.

Hans Richter an enthusiastic German glider, is here shown in the air. After running down hill, he draws himself up into the machine

Daylight Saving for Plants

Speeding up growth by controlling exposure

By M. De Witt Pearl

TWO investigators, Dr. W. W Garner and H. A. Allard, of the Bureau of Plant Industry at Washington, find that the length of the day is of the utmost importance in determining when a plant shall fulfill its primary function reproduction. This does not mean that heat or cold, intense or dim light, have no influence upon plant development, but simply that a plant is profoundly affected by the length of time it receives light.

After some preliminary experiments, a large "dark house" was constructed which, although allowing of free circulation of air, excluded all light. At no time was the temperature in the house enough higher to account for the results obtained.

The experiments usually began with the seedling stage. Always control experiments were conducted at the same time. That is, with the germination of the seeds of the type to be studied, some were placed in trucks to be run into or out of the dark house, according as the length of day was to be shortened or lengthened. In other trucks were placed the remainder of the seedlings, and these received precisely the same treatment, except that they were the recipients of normal sunlight. The time of exposure to daylight for the experimental plants was twelve, seven, and five hours.

The plants used in the experiments were several varieties of soy-beans, aster, violet, radish, ragweed, hempweed, beans, carrots, lettuce, hibiscus, tobacco, cabbage, and goldenrod. Beans, which under normal conditions in the regions about Washington blossom one hundred and nine days after germination, would, when their daily supply of light was reduced to seven hours, blossom in twenty-eight days, and a month later produce mature seeds

Maryland mammoth tobacco, which can never be made to produce seed during the summer when grown by the ordinary out-of-door method, would, under the influence of a shortened day of seven hours, form seed-pods by the fourth of August Ragweed also performs its best work on a short-day basis. On the other hand, hibiscus, cabbage, and carrot reach maturity more rapidly on a long-day basis.

Another interesting result obtained in juggling the amount of daylight that the plants received was the transformation of certain species from annuals into biennials, the entire process being completed in these cases in a few months instead of two years.

Soy-beans, brought quickly to the flowering stage in the early summer by a shortened day, were then subjected to a period of lengthened daylight. The result was that the seeds ripened quickly, the leaves turned yellow, and the plants gave every appearance of following the normal course that such plants follow under normal conditions of blossoming in the fall. However, these plants that had been brought to an early maturity soon put out fresh shoots, which in turn produced blossoms while the plants were still bearing the first crop of seeds.

Soy beans require a short day and a long night. The plants on the left were exposed to light five hours daily from May 20 till June 16, when the first blossoms appeared. The plants on the right, exposed to daylight all day, grew luxuriantly, but did not flower until September 4

Dr W W Garner and H A Allard, of the Bureau of Plant Industry at Washington find the length of day an important factor in plant life

A Folding Cot for Home and Hospital

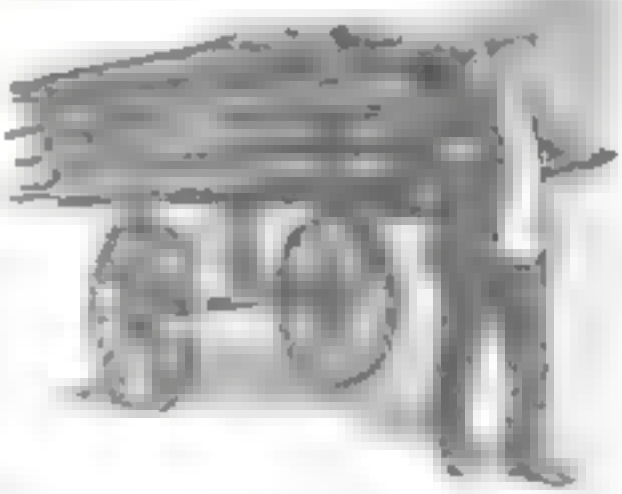
UNLESS the present housing difficulty is remedied in the near future, millions in this country may be compelled to sleep in cots instead of wooden or metal beds. In Germany, where the shortage of housing space is equally acute, a new type of cot is finding favor.

The cot is light and easily unfolded and folded.

When folded up, it occupies but little space and may be stowed away in a closet to be set up again in any convenient place for use as a resting-place at night.

Even where the shortage of accommodations is not excessive, it is convenient to have one or more of these cots on hand in case of emergency, for instance, where unexpected visitors spend a night at one's house.

It looks very comfortable made up A number of these cots might be kept in a store room for emergency



These cots are so light that when folded a number can be carried on a hand-truck, they are specially useful in a camp

Reading a Ship's Draft from the Bridge

With this invention a shipmaster may know at a glance the draft, trim, and cargo weight of his ship

THAT a ship's master should know at all times, both at sea and in dock, the draft and trim of his ship is imperative. In dock, if he has the means of reading the draft as the hull gradually sinks lower and lower into the water as the cargo is taken on board, he can tell the progress made in loading, the weight of the cargo, and just when the boat has taken aboard the greatest amount of cargo it can carry with safety. Again, if he has some means of knowing the trim of his ship, he will be able to judge whether or not the cargo is being properly stowed.

For centuries the draft of ships and the manner of determining the trim from the draft has been recorded by the same crude method of reading the marks on the outside of the hull, at the bow and stern of the vessel. These readings are added together and the total divided by two. The resulting figure, called the mean draft, is then applied to a scale, furnished by the ship's builder, to ascertain the tons displaced. It will be seen that this method may be far from accurate and can be applied only in still water. In the dark its use is altogether out of the question.

The Instrument in Detail

There has been devised a very simple and practical instrument that shows accurately and constantly the degree of submersion at any point of a vessel's hull, which is, of course, the draft at that point. Usually the readings made by this instrument are taken at points at the bow and stern of a vessel; sometimes amidships as well. The device consists of a balance-chamber, a mercury (or other) gage that is calibrated or scaled in feet and inches, and the corresponding weight and volume, an air-pump, and a control valve that is connected to the gage and to the balance-chamber and air-pump through small piping.

The balance-chambers, connected to one-inch sea-valves, are located at predetermined points, forward and aft, below the light-draft line of the ship, and are connected by quarter-inch copper tubing to the mercury columns of the registering part of the instrument. This register or gage is located either on the bridge or in the captain's office, where it may be conveniently consulted by the navigating officer. The water, in trying to enter the balance-chamber, compresses the air in the pipe leading to the mercury-gage and causes the mercury to rise or fall in direct ratio to the vessel's draft.

With this instrument, which may be placed in the captain's office or on the bridge, the navigator can tell at a glance the draft and trim of his ship

In operating the instrument, the control valve is first shut and the line from the reservoir is opened to admit air into the balance-chamber. When this is done, the air reservoir is shut off and the control valve opens the pipe line between the balance-chamber and the gage. In the gage are two mercury columns, one showing the draft forward, the other the draft aft.

How the Mean Draft Is Obtained

When the forward draft is determined, a knife edge traveling on a rod beside the forward mercury column is set exactly at the top of the mercury column. The same thing is done with the aft mercury column, which has a like knife edge fitted in a rod beside it. When these two knife edges are in place, a central knife edge automatically registers the mean draft and the corresponding tons displaced. The mean draft may be obtained direct by having a third sea connection amidship installed and assigning to it its own gage. As the displacement or dead weight of a vessel represents its weight and all it contains, the amount of weight put on board or taken off the vessel can be readily ascertained by taking the difference between the two successive readings of the dead-weight scale.

Two Palm-Leaves Make a Rain-Coat

IN the Philippine Islands rain-coats are not made—they grow by Nature's grace. When the thinly clad native is caught in a storm, he goes to the nearest palm-tree, plucks two of the largest leaves, and hangs them from his shoulders—one in front and one in back.

If he is at all particular about his hat, he will spread a third leaf over it.

Rain-hats, however, are common in the Philippines. They are made of closely woven palm-leaves and are conical in shape. The Filipino shown in the picture above is wearing one as well as his rain-coat.

Relics of the Vikings

ON Victoria Land, north of our continent, stand the remains of stone houses built undoubtedly by the navigators, who, as far as we know, were the first to visit this continent from the Atlantic side.

Humboldt affirms that the Mongols first voyaged to the shores of the western coast several thousand years ago.

The picture below was taken on Victoria Land, north of the Dolphin and Union straits, by W. V. Bruce, of the Canadian Arctic Expedition. The man standing with an alpenstock is Dr. Anderson of the expedition.

You Can Wear This Bed

CAN you sleep lying flat on your back all night? If so, you will be interested in a combination bed and overcoat recently invented by Mrs. Ray Werner, of San Francisco. With such a coat on your back you can sleep in comfort anywhere. It is recommended to soldiers and campers.

A water-tight, airproof bag is rolled up and attached to the coat at the shoulders, another smaller bag is placed just above it. Neither bag weighs much, and thus they do not bother you. When night comes, you unstrap them and blow them up as you would a basketball: there are two valves quite near your mouth for the purpose. The lower bag spreads out and becomes a mattress, the upper one a pillow. If you carry a pack, you might slip it underneath the pillow.

Crossing the English Channel in Nine Minutes

FLYING at the rate of 200 miles an hour, R. Vaughan Fowler, with two passengers, flew across the Channel, thirty miles, in just nine minutes. The trip was made in a D.H.4 equipped with a Rolls Royce Eagle engine of 375 horsepower. The whole distance from Cricklewood to Paris was made in 1 hour and 45 minutes.

Testing the Temper of an Eskimo Dog

WITHOUT the dog the discovery of the North and South Poles would have been impossible. To the Eskimo and Indian of the far north the dog is a necessity.

The Indian, less intelligent than the Eskimo, lets his dogs run wild in the summer.

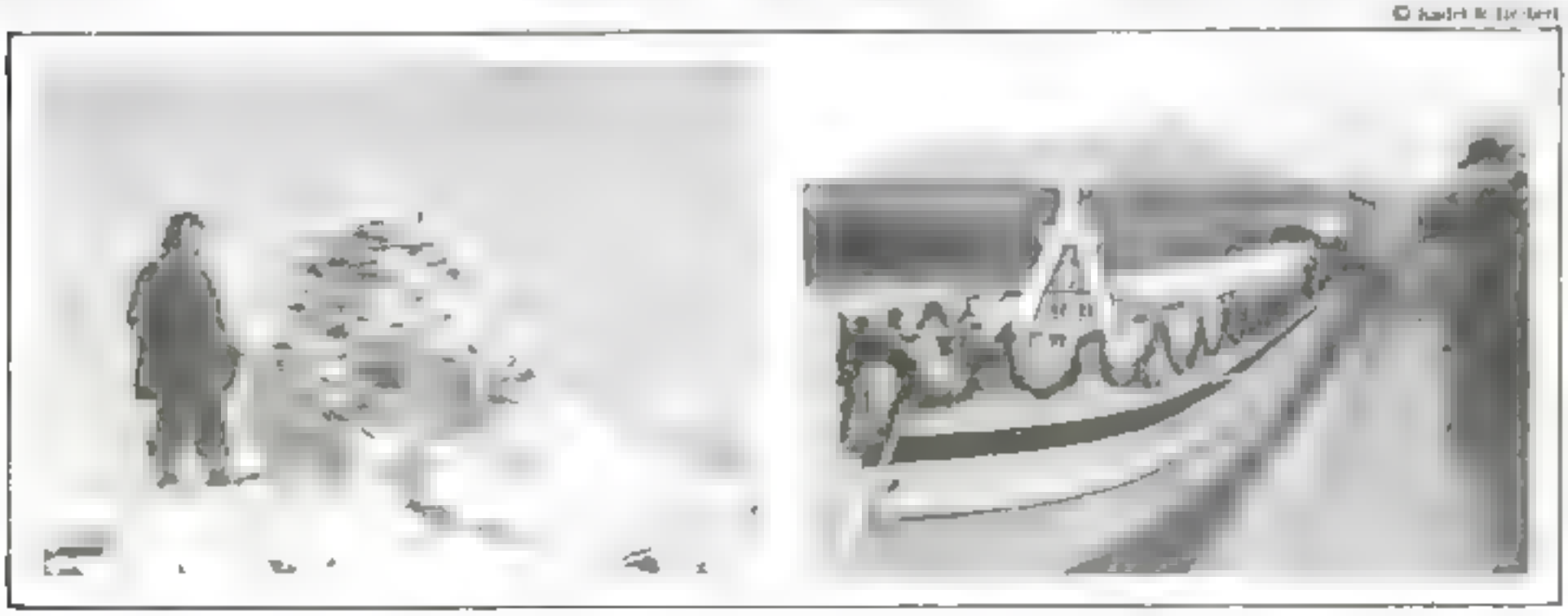
The picture represents the way Captain Patten, of the Hudson's Bay Company, tests the disposition of his dogs. If the dog submits to the test without showing a vicious nature, he is petted and allowed to run with less restriction than a dog showing a less kindly disposition.

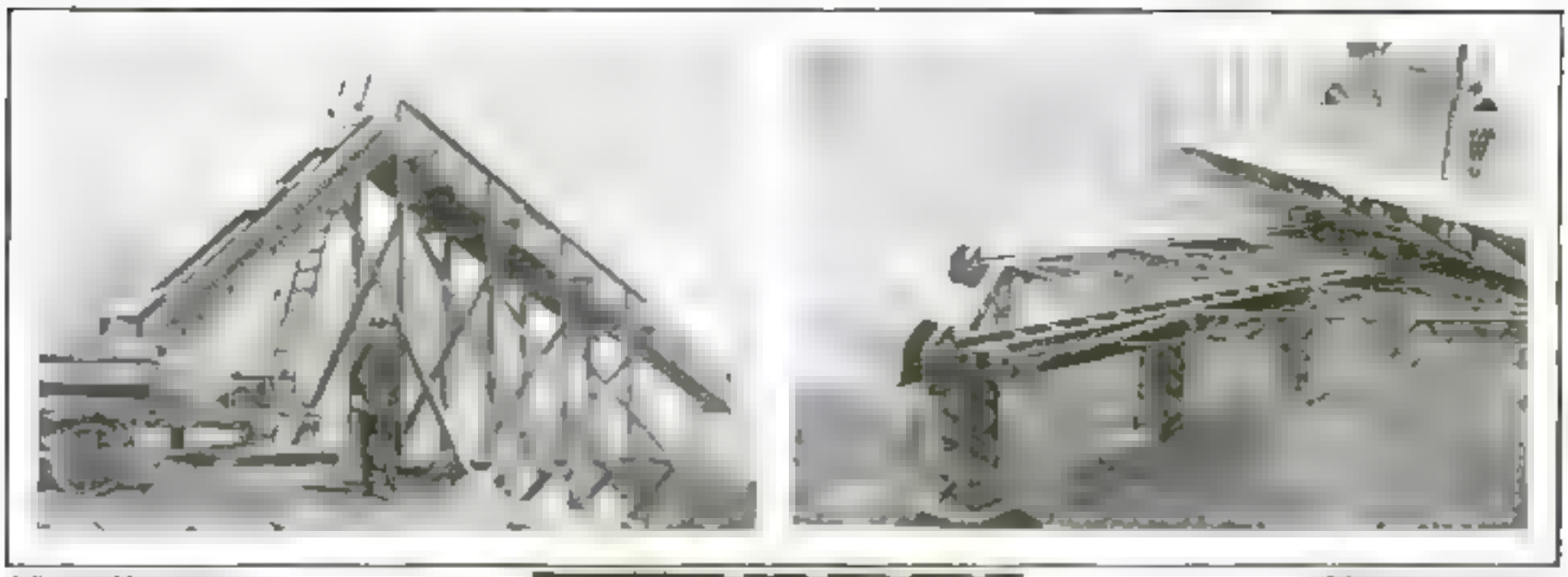
Berlin's Floating Church

THE sailor is supposed to be a peculiarly godless specimen of the human species. His swearing has become proverbial. He hasn't the opportunity to go to church, which, according to some, accounts for his carefree attitude toward this life and the life to come.

In most parts of the world they have established churches for sailors. The most pretentious of these is the seamen's church of Berlin.

Just why Berlin should have such a church is a mystery. It is not a seaport. But perhaps the swearing variety of German bargeman needs religious instruction.





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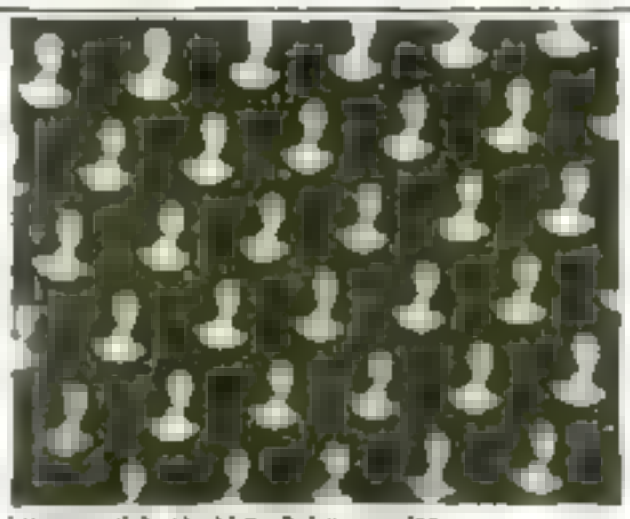
Burning Boxes Wholesale

COCONUT oil is highly inflammable and to prevent a serious fire the boxes in which it is shipped from the tropics must be destroyed immediately after they are emptied.

They are loaded on a heavy truck and carried to the foot of the mechanical conveyor shown in the picture above, by which they are carried to the top of the chute. They slide from this point into a great bonfire where hundreds of them come to the end of their long journey daily.

They are burned on a sandy beach to prevent the fire from spreading.



Seen through a Fly's Eye

A FLY'S-EYE view" has been made possible by photographing the images formed by the lenses of a fly's eye. Unlike our own eyes, the eyes of various insects and flies are composed of a number of lenses.

The lens of the human eye forms but one image upon the retina; but the lens of a fly's eye forms a number of images too small to be seen except by microscope.

A powerful microscope was arranged to focus these images upon the photographic plate. A statue was the object whose image was formed by the multi-lens eye, and here we can see a few of the images of the statue as seen in a "fly's-eye" view.

The Diagonal Sliding Drawbridge

THERE are many kinds of drawbridges, some revolve, some swing upward, some swing sideways. And now there is one that swings sideways and backward at the same time, traveling in a straight diagonal line. Since a straight line is the shortest distance between two points, perhaps this drawbridge will do its work in the shortest possible time.

The bridge is mounted on wheels that travel on rails that are placed at an angle of forty-five degrees to the river and the bridge. When a boat wishes to pass, the bridge-tender operates a winch that pulls the bridge sideways and backward on the tracks, until it is no longer over the river.

Guided by the Light on a Cloud

IN the night, when low clouds float in a thin veil above the river, where searchlights on battleships throw their beams upon them, a curious round patch of light can be seen on a cloud. Airmen flying above these clouds would also see the patch of light and, in clear weather, the long beams cast upward into the sky.

The suggestion has been offered that airlighthouses should be provided with vertical searchlights of great power. Even in moderately foggy weather the light would penetrate the cloud of mist and be visible from above.

What the Waves Did to These Rocks

"WATER wears away a stone" is a literal truth that any one can see proved any day by observing the coast of a large body of water.

Upon the shore of the Bay of Fundy, where the tides rise higher than anywhere else in the world, can be seen curious wave-worn rocks, such as are shown in the picture to the left.

The fantastic forms at Hopewell cape have been produced by water that has washed away the less resisting portions. So little is left of the bases that the rocks are almost in an unstable condition. Of course, in time they will come down with a crash. But today they stand like pylons at the gates of the sea.

Their size can be estimated by comparing them with the figure of the man standing beside one of them.

Miners Drill Coal with Compressed Air

ALWAYS there is a need for a compressor that will compress, wherever it may be. This machine is electrically driven and carries its feed cable with it

Here it is shown at work in a coal-mine, supplying compressed air to a coal drill. It is mounted on a truck so that it may roll on the same track used for the mine locomotive

A small air-tank built for high pressure is carried on the truck and the supply is furnished from this.

This compressed-air outfit is not only used in coal-mines, but for hammers, cement-guns, punches, etc

© Keystone View Co

Sucking Up Grain through a Big Pipe

THE manager of this grain-elevator has certainly got the right idea about unloading grain and moving it from one part of the grain-elevator to another He uses the same principle as that employed by the vacuum cleaner

Large vacuum pumps are connected to the big pipe shown in the center of the photograph This carries grain away as fast as the workmen can keep it piled up at its mouth. Many hundred tons may be sucked away in a single day.

The suction type of conveyor also tends to eliminate dust and thereby helps to prevent explosions

X-Raying Finger-Prints

FINGER-PRINT identification is based on the possibility of examining and comparing under the magnifying-glass the prints of an inked finger

A specialist in the field of criminalistics, S. Nelken, of Berlin, has devised an important improvement in this art X-ray pictures of the finger with the muscles and bones are obtained. This is done without the use of any chemicals that can obstruct the delicate furrows of the finger-lines. Moreover, the finger bone is shaped so characteristically as to aid identification.

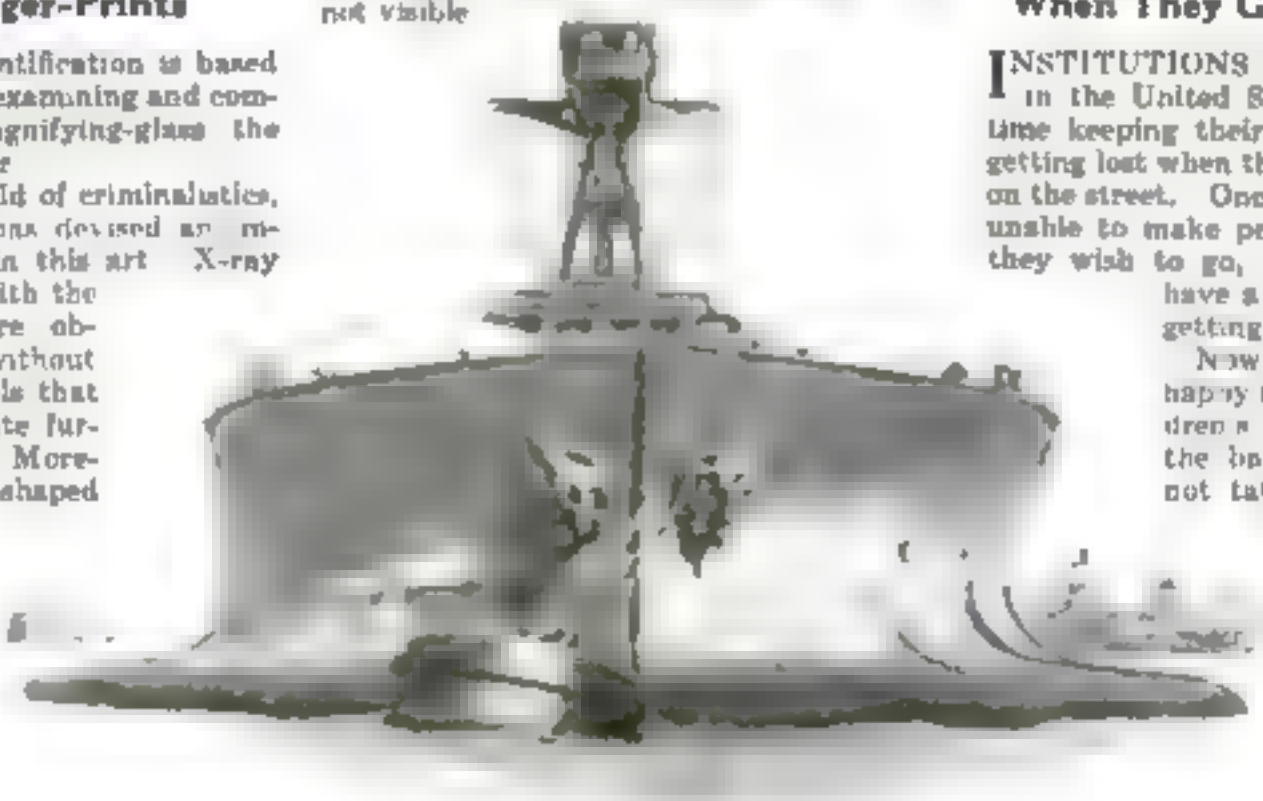
Whenever there is a certain likeness of finger lines, the bones are examined to see if further research would be necessary.

She Is a Mother to Busy Little Submarines

HERE'S a queer-looking craft. She was not built for speed—that is apparent in her bulkiness, which is anything but the grace of speed-craft. British naval experts designed her to watch over submarines and to carry their supplies

The big steel "blisters" at each side are filled with water to ward off torpedo attacks If a torpedo strikes these "blisters" and tears them open no harm is done since they are filled with water. Therefore the buoyancy of the vessel is not affected in the least

The big vessel, lazy as she looks, is not strictly a fighter. Still, in the event of having to protect herself, she has a number of small guns mounted above and below deck, although they are not visible



When They Got It in the Neck

INSTITUTIONS for the deaf and dumb in the United States have a very hard time keeping their juvenile charges from getting lost when they are permitted to go on the street. Once they are lost, they are unable to make people understand where they wish to go, and consequently they have a great deal of trouble in getting back to their institution.

Now some one has hit on the happy idea of writing the children's name and address on the back of the neck It is not tattooed on that would be too cruel and would savor too much of branding An indelible pencil is used, the markings of which may be removed when they have served their purpose.

Put a Collar on the Bag for Safety

THE closing arrangement for bags shown in the picture above has proved to be of great value where numbers of bags have to be closed securely

It consists of an elastic metal band with teeth on both edges, and a T-clasp, provided with a hole for the insertion of a padlock. These bands are made in a variety of sizes to conform with the varying thicknesses of the necks of the bags when closed

The material is gathered by hand, a suitable metal band placed around the neck, the T-clasp slipped in the slot at the opposite end of the band and, if necessary, a padlock is put through the hole in the clasp.

Painting One Office Building to Look Like Its Neighbor

NEW-YORKERS, who rate their city's skyline as the most impressive in the world, were particularly pleased when the Bush Terminal Company erected a towering Gothic structure just west of the shopping zone. The delicate lines of the walls and the tower drew forth expressions of praise. But when the Wurlitzer building began to rear its walls beside the Bush building, these art lovers felt affronted

The painters employed on the Wurlitzer building transformed its blank wall into a thing of lights and shadows, making it appear to be of Gothic design. These painted lines blend with the design of the Bush building.

Illuminate the Stocking to Darn It

HERE is an idea that will make darning easier. A new darning-last of oval form has been invented by Edna C Smith, of Clifton Forge, Virginia. It is made of translucent material and is arranged to screw into a socket over a small electric lamp. The electric lamp illuminates the inside of the last and enables the darner to see the threads of the woven fabric; it is then easy to do a smooth darn.

This invention also enables one to discover minute defects in any material.

An ordinary flashlamp serves as the illuminant, and the translucent "darning-egg" is satisfactory for both light and dark materials.

How the Earth Revolves

CAN you shut your eyes and see the earth go around the sun? If you have seen the interesting model shown here, it is possible to form a good idea of how our planet is tilted at any time of the year with relation to the great solar orb in the center of the solar system

In imagination extend a line from the earth to the sun's center. Wherever this line intersects the surface of the sun, a mere dot on the great solar sphere would indicate the position and size of the earth as projected there.

Freeze Fruit to Keep It

STRAWBERRIES, grapes, cherries, raspberries, and other small fruits, as well as tomatoes and some other vegetables, can be kept a long time intact from the germs that bring about decomposition. Germs may be present in the air and in the fruits, but their activity is suspended by freezing.

The Department of Agriculture has found that fruits frozen to a temperature as low as 10 degrees F. or higher, up to 32 degrees, and then stored in a temperature not above 16 degrees, will keep for several months

© Kadel & Herbert

Practising Golf Strokes on Board Ship

HOW hard can you strike the ball? That is one of the secrets of good golf-playing. It is the kind of stroke and the strength of stroke that counts

When any one wants to succeed in any pursuit, keeping in practice is essential This is true of golf as well as anything else, so a champion golf-player has devised this clever machine to keep in practice even while crossing the ocean on a steamship.

The device is so arranged that the quality of stroke is registered on an indicator. The ball itself is fixed so that it can not be driven into the sea. Otherwise there would be a lively time chasing golf-balls on the water with life-boats

Not only is the golf machine suitable f r the deck of a ship, it is also of service to the "champion player" who wants to practice indoors, providing he has moderate space at his disposal.

Castles in California

WHILE Mrs. McClain, of Alhambra, California, was building castles in the air, her son started building them on the ground. He built two of them - Diamond Castle and Tiree Castle, both duplicates of large castles in Scotland near which Mrs. McClain lived for many years

The duplicates are very much smaller than the originals, but they are alike in every respect. The rooms measure about eight by ten feet and are six feet high; the stairs are barely wide enough for a fat person to climb

Mrs. McClain and her clever son live in the smaller castle, the Tiree, and can see the larger castle, the Diamond, from their windows. The Diamond is shown herewith.

Not many people can have the scenes of their youth actually recreated for them as Mrs. McClain has had.

Train a Tree in the Way It Should Grow

A MAN is shown above, fastening a vine to a wall. You may wonder what is unusual about that

The man is training a fruit-tree to climb the wall of his garden in France, thus achieving utility as well as beauty

By this method Europe has long ignored Nature's ideas on how a tree should grow and when it should blossom.

Planted against a wall with a southern exposure, a tree has no option but to grow in one direction. As each branch sprouts, it is gently trained by cloth strips in the way it should grow. The sun-warmed wall encourages the tree's growth, and months before the usual bearing-time, the wall-tree has ripened fruit to offer its owner

With patience, it is possible to train almost every kind of fruit-tree to grow in this manner

A Machine that Travels from Job to Job Crushing Stone

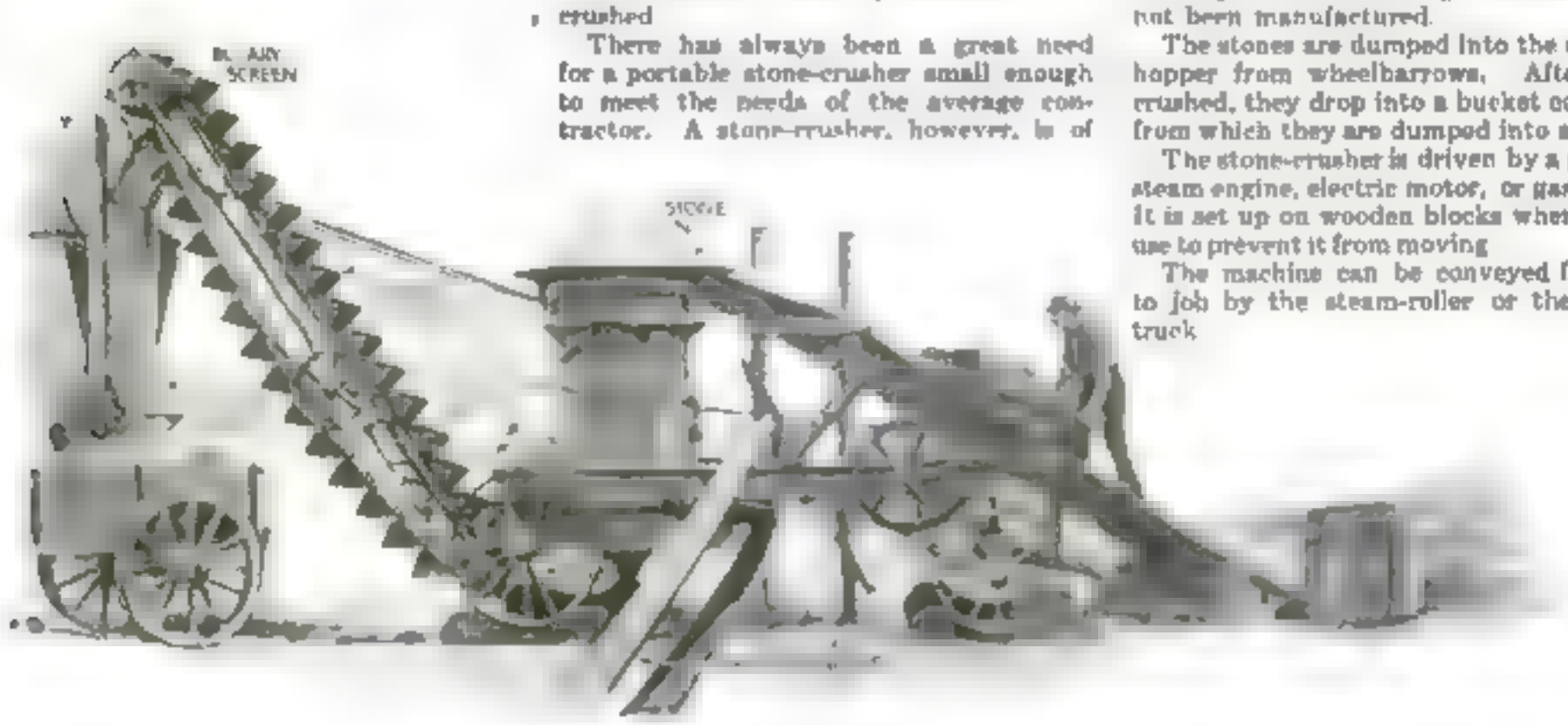
THIS machine is always on the job when there are any stones to be crushed

There has always been a great need for a portable stone-crusher small enough to meet the needs of the average contractor. A stone-crusher, however, is of necessity such a heavy machine that until recently a successful light machine had not been manufactured.

The stones are dumped into the crushing hopper from wheelbarrows. After being crushed, they drop into a bucket conveyor, from which they are dumped into a wagon.

The stone-crusher is driven by a portable steam engine, electric motor, or gas engine. It is set up on wooden blocks when it is in use to prevent it from moving

The machine can be conveyed from job to job by the steam-roller or the motor-truck



"Opera Seats" in Street Cars

IN the street-car where the seats are arranged in rows with an aisle between the passenger next to the window who wishes to get out must cause the passenger on the aisle end of the seat to step out into the aisle or possibly have his toes trodden upon.

This inconvenience is alleviated by making the seats so that they can be raised, thus requiring the end passenger merely to stand to permit the other to pass. There is plenty of room and no danger of stepping on the other fellow's toes.

Such an arrangement saves the time of the railroad company. The delay caused by the passenger who wants to get out, but has to wait for the end passenger to step into the aisle, and the resulting confusion, is detrimental to good service. The new-style car seat is thus an advantage in the correction of this fault, to say nothing of tempers saved.

What Happens to Wooden Propellers in a Storm

WHEN an airplane tries to make headway through a storm, the speed of the machine adds to the speed of the flying missiles and raindrops become bullets. Lieutenant Charles B. Austin, flying from the Panama Canal Zone to Washington, was turned back by his encounter with such a storm. The effect of his battle with the elements is shown by the propeller.

There is a new kind of propeller made of bakelite which would have withstood the storm. In one test of this material, the airplane nosed over in a muddy field, the propeller churning up the mud to a depth of twelve inches.

Simplifying the Movie Spotlight

CORRECT lighting is even more important in making a movie film than it is on the stage. When the spotlights are mounted high, only the lamphouses are elevated, as on the top of a wall; it would hardly be practicable to raise the stands.

But this spelled trouble. The electrician on high had to pull out the plugs to extinguish the light at the command of the director; the switch was on the ground below. The result was arcing, and arcing in turn pitted the connectors. Pitting meant a flickering light.

Claud Harding, chief electrician of the Lasky studio in Hollywood, California, and Frederick S. Mills, manager of the electric department, solved the problem simply by removing the switch and switch-box from the stem of the spotlight and mounting them on the back of the lighthead. They are always within reach. It will no longer be necessary to renew the connecting plugs several times a year at much expense.

Where Steady Nerves Count

AUDIENCES in vaudeville theaters are familiar with the expert juggler's entertainment. He keeps a number of balls in the air, deftly catching them in his hands and alternately catching some of them in little pockets on his shoulders and on his back.

One of his most clever tricks demonstrates just how steady one's "nerve" can be trained. On his back he juggles three balls, sending first one, then the others, into their respective pockets. He does this by making one ball strike another.

Any one who plays billiards knows that the art of sending the ball in the desired direction is a clever calculation of angles, followed by an accurate stroke with a cue.

How does this man accomplish his results?

Music in Two Tin Cans

RESURRECT two tin cans, attach them to the opposite ends of a piece of wood, and run a D or A violin string from one can to the other. The cans will furnish the resonance that is usually supplied by the body of the violin. Of course the range won't be as great as when four strings are used, but if you use either of the medium-toned strings, you will be able to play practically any tune.

In the southern part of the United States it is a common thing for people to make rude musical instruments. At harvest-home festivals, notably in Atlanta, Georgia, one or more days are set apart for contests at which people, mostly from remote mountain regions, play these home-made contrivances for prizes, in groups or singly.

In a Bottomless Pit of Ice

"Are you all right?" came a voice from above. "Yes, but I can not get up, I'm hung here," was the answer. "Hang on, then!" shouted the man above.

The man in the crevasse dangled helplessly over the bottomless icy pit, while his arms and legs gradually froze.

This was the experience of John Lachlan Cope, surgeon and biologist of the latest Shackleton antarctic expedition. To intensify the situation, the crevasse gradually widened.

But the sledge harness from which he dangled saved him for it held firm. Dr. Cope's friends on the glacier above made a rope ladder and on this, painfully and with infinite precaution, the surgeon slowly climbed back to comparative safety.

In a Bottomless Pit of Ice

How an explorer fell into a crevasse and how he was saved

By Philip Schwarzbach

DANGLING helplessly for hours over a bottomless pit of ice while arms and legs gradually froze—that was the experience of John Lachlan Cope, surgeon and biologist to the Ross Sea party of the Shackleton antarctic expedition.

Mr. Cope (in Great Britain surgeons are called Mr.) had been leading three men over a dangerous glacier and had failed to notice a crevasse that was almost covered with snow. Suddenly he felt the snow give way, and he fell headlong through space. The sledge harness, however, saved him. It was fastened around his chest and shoulders, and it held him suspended twenty feet below the edge of the crevasse. Fortunately, his companions saw him fall, and they immediately made fast the sledge ropes.

Seen from a Rope's End

Cope looked around him. The crevasse in which he hung widened as it extended down into the earth. Huge columns of ice jutted out here and there. Some were blue in color, others a whitish pink. Many of them were weird and grotesque in shape. The crevasse continued to widen until its sides disappeared from view, and below that darkness and illimitable depths!

"Are you all right?" came a voice.

"Yes, but I can not get up; I'm hung here."

"Hang on, then!" shouted the man above. "We'll make a rope ladder."

With that he disappeared.

It grew colder and colder in the icy crevasse. Cope's mitts fell off, and he watched them drop, striking the ice, until they disappeared from sight. His hands were soon numb and his body half frozen. Now and then the roar of ice falling down some far distant crevasse broke the silence.

At last the ladder was finished, and the men lowered it. All sense of touch being by this time gone, Mr. Cope had to watch his hands to see that they clutched the rope as he climbed. Swinging backward and forward over the pit, he gradually made his way toward the top. But just before he reached it his harness came off. If he slipped, nothing would save him from being dashed to pieces. He was so numb and exhausted that his legs would not stretch far enough to reach from one rung of the ladder to the next.

He called up faintly to the men and they lowered the harness until he was able to push his legs through it. Half sitting in it and feebly grasping the rope ladder, he was hauled the few remaining feet to the surface. He had been hanging over that bottomless pit for three and a half hours!

The Antarctic Once More!

This intrepid explorer was later marooned for two years on Ross Island. Yet when he returned to civilization he immediately began to plan another trip to the antarctic. In this trip he intends to circumnavigate the entire antarctic region. It will take him at least five years. Captain Scott's old ship, the *Terra Nova*, has been put into commission for the job. An airplane will be carried on board ship and, if conditions are favorable, an attempt to fly to the pole will be made.

The ship will go back to New Zealand, stock up for a four years' cruise, and then return to the Ross Sea, where the six men, left the year before, will be picked up. Then she will take up her task of circumnavigation.

Mr. Cope hopes to keep in touch with civilization by means of wireless all during his trip.

Extinguishing a Fire with Soda Water

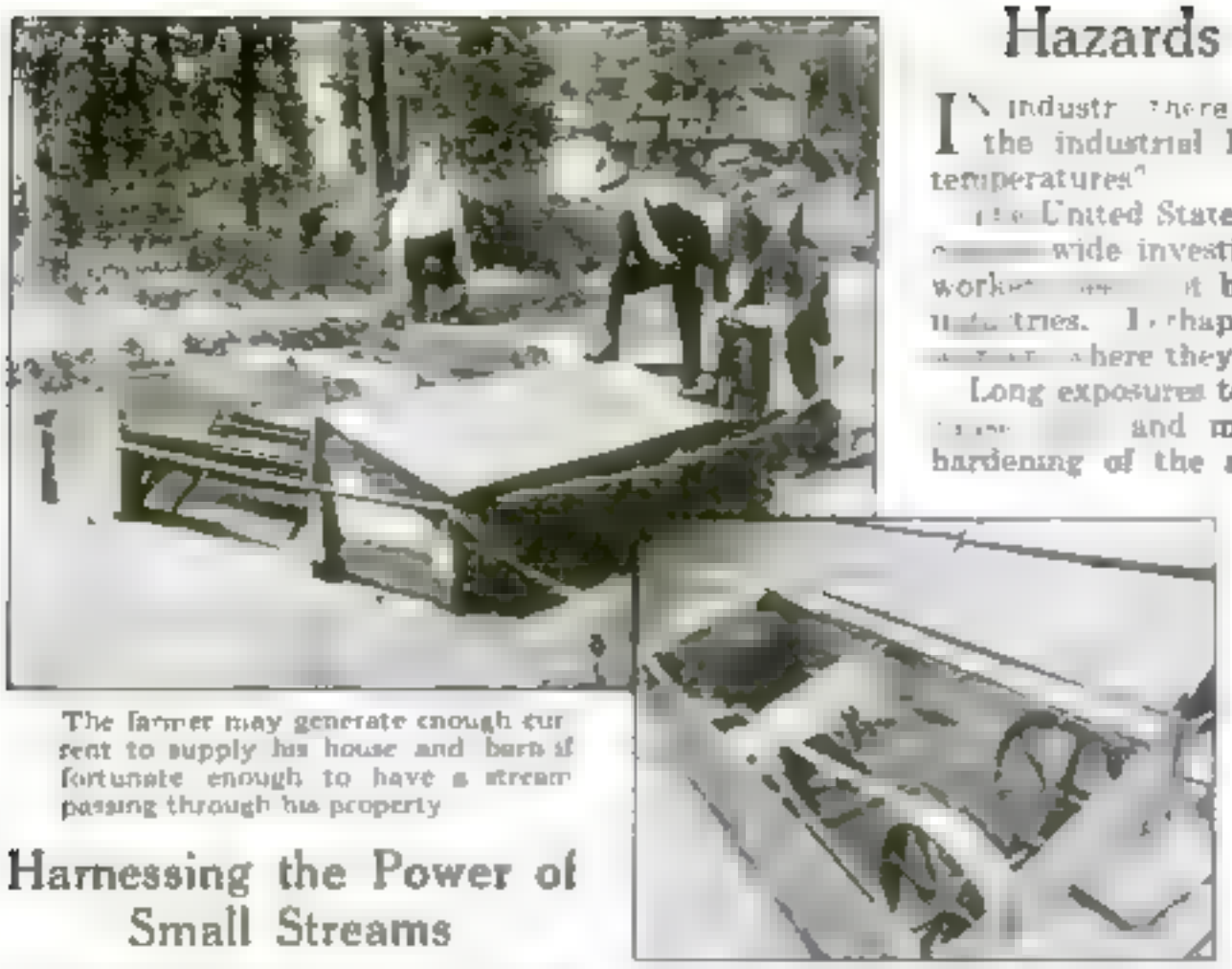
A BIG fire was raging in the filling under a railroad trestle. The railroad company had placed in the "fill" some ashes that contained some unburned coal. This was covered with blast-furnace slag. Spontaneous combustion occurred, and in a few days' time the bottom of the fill was a roaring furnace which forced the railroad company to abandon its service.

Mr. J. A. Thomas, a fire engineer, was called to the scene. He was confronted with the problem of saving the fill, since the railroad company did not want to go to the expense of filling in the valley with fresh material. This made the use of high explosives impossible. Mr. Thomas immediately decided to use a solution of carbonate of soda. Sixteen thousand pounds of soda was brought to the scene. This was dissolved in water and pumped to the fire through a two-and-one-half-inch hose. When this solution came in contact with the hottest parts of the fire, violent explosions occurred, throwing great volumes of slag and ashes high into the air. However, the explosions were not severe enough to spread the contents of the fill over a great area. After a few hours' work the fire was completely subdued.

It is claimed that a solution of carbonate of soda has a far greater cooling effect than water. The carbon-dioxide generated with this solution, coming in contact with a highly heated material, also tends to smother the fire. One gallon of a solution of carbonate of soda has a fire-extinguishing effect equivalent to one hundred gallons of water.

Carbon tetrachloride is a very efficient fire-extinguisher, but it is more expensive than the soda.

Pouring tons and tons of a solution of carbonate of soda into the hot fire. Violent explosions occurred that flung the earth and ashes many feet into the air



The farmer may generate enough current to supply his house and barn if fortunate enough to have a stream passing through his property

Harnessing the Power of Small Streams

WHEREVER water runs to a lower level, there is power. This power is not commercialized because the total power obtained from each stream would not warrant the necessary investment in a dam and power plant. This can be done only in the case of high falls or a stretch of rapids where the water takes a large drop in a short distance.

This power unit will generate current for domestic use if placed in the middle of a small stream with a current flow of two or more miles an hour.

Two water-wheels of the undershot variety are used; they will drive a 500-watt generator

Two water-wheels of the undershot type are used. These drive a small 500-watt generator, which is capable of supplying about twenty 25-watt lamps with current.

Hazards of Heat in Industry

IN industry there are the so-called "hot jobs." What are the industrial health hazards of working under high temperatures?

The United States Public Health Service is undertaking a [illegible]-wide investigation. Perhaps it may turn out that workers [illegible]t be exposed to high temperature in some industries. Perhaps methods can be devised of protecting [illegible] where they must of necessity be exposed.

Long exposures to heat lower the general health and may [illegible] and muscular rheumatism, skin disease, and hardening of the arteries. Both employer and employee suffer, the one in business and the other in earning power and health.

It is likely that the investigation of the United States Public Health Service will show that hot-water and steam pipes, boilers and fire-rooms, have been improperly placed, or that steam-operated machinery has been placed unnecessarily near boilers.

Heat can be greatly diminished by water-jacketing boilers, by insulating glass surfaces with double walls of fire-brick, and by kindred devices. Big electric fans will keep the air moving and make hot rooms more comfortable. Burning, radiant heat can be screened by wire or loosely hanging chains through which the workmen can pass.

Sixty Miles an Hour in a Wind-Car

THE thrills of an airplane, the safety of an automobile, and the economy of a motorcycle, all are combined in the propeller-driven car designed by Sheldon F. Reese, of Huron, South Dakota. In a six-hour endurance test this car ran sixty miles on forty-eight cents' worth of gasoline.

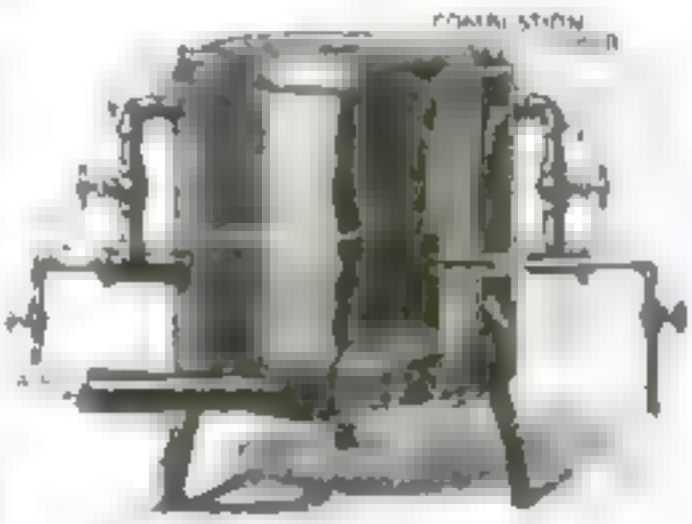
But two control levers are required. One spark lever controls the engine, while a foot lever controls the brake. The motor can be started from the seat. The work of repairing is greatly simplified and can be done without the aid of mechanics. The distribution of weight is so devised that the car is easily managed by hand; it weighs only 160 pounds.

The air-propelled propeller is guarded by a broad metal hoop around the tips of the blades. The motor is fitted with mufflers which suppress much noise.

In winter this little machine is as useful as in the summer. It can be run to the river or the lake and there quickly converted into a complete iceboat merely by substituting ice-runners for wheels. The motor is air-cooled, so that there is no danger of water in the radiator freezing. Equipped as an iceboat, the machine weighs slightly more than 150 pounds and its speed varies from four to sixty miles an hour on the ice.

The car carries two persons. A twin-cylinder engine of six horsepower is mounted on the rear axle. The propeller is made of walnut and is eight by twenty-eight inches.

Here is an automobile driven by a propeller. It makes sixty miles an hour at less than one cent a mile



The oil circulates through the outer casing of the furnace before it passes into the burner

Warm the Gas Before It Burns

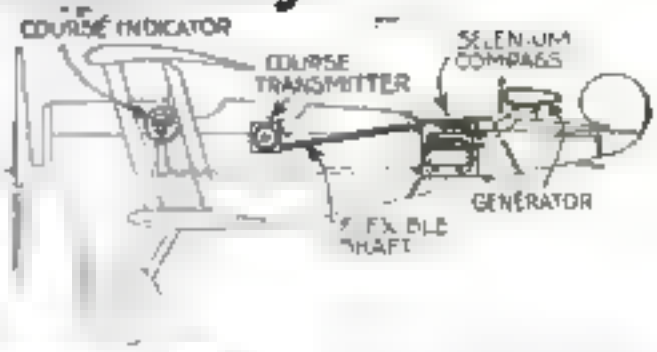
OIL vapor and air are mixed and heated before entering the combustion chamber of this furnace.

The air supply first circulates through a casing arranged about the combustion chamber. This compartment is kept very hot and the air passing through is raised to a high temperature. The air leaves the compartment and mixes with the oil vapor just before it enters the combustion chamber.

The pre-heating of the air prevents cold air from reaching the refractory lining of the furnace. Thus the heating of the air also results in longer furnace life. A small blower keeps air circulating through the outer casing of the furnace. The oil is also fed to the burners under pressure.

Steering an Airplane Automatically

By Dr. Alfred Gradenwitz



USING ordinary compasses on board airplanes involves a number of difficulties, of which the influence exerted by iron parts is the most serious. This is why the instrument designed by Carl Bamberg, called a "remote control compass," deserves attention.

As the mechanism of the compass in the new invention need not lie in view of the pilot, it can be installed far from all iron parts (preferably from three to five feet behind the rear seat in the hull). Moreover, there is no objection to using as strongly magnetic and accordingly as reliable a compass as on board sea vessels, thus increasing the accuracy of readings.

Arranging the new compass that makes use of selenium cells, lenses, an incandescent lamp, and a magnet

The magnet system is, as usual, hung up in a compass bowl filled with alcohol-water. At the bottom of the bowl are two lighting systems, each consisting of a small electric incandescent lamp and a set of lenses to cast two beams of light through the compass liquid. These two beams strike two selenium cells, the electrical resistance of which drops as they are lighted, allowing an electric current to pass, and causing the hand to deflect.

Now, each magnet system carries a diaphragm, which, in a given position, covers both beams of light, thus leaving both selenium cells in the dark. As the compass bowl is turned around its vertical axis (the magnet system remaining in its previous position pointing north-south), one or the other of the selenium cells will emerge from the shadow of the diaphragm into one of the two beams of light, thus causing the electrical indicator to deflect to the right or left.

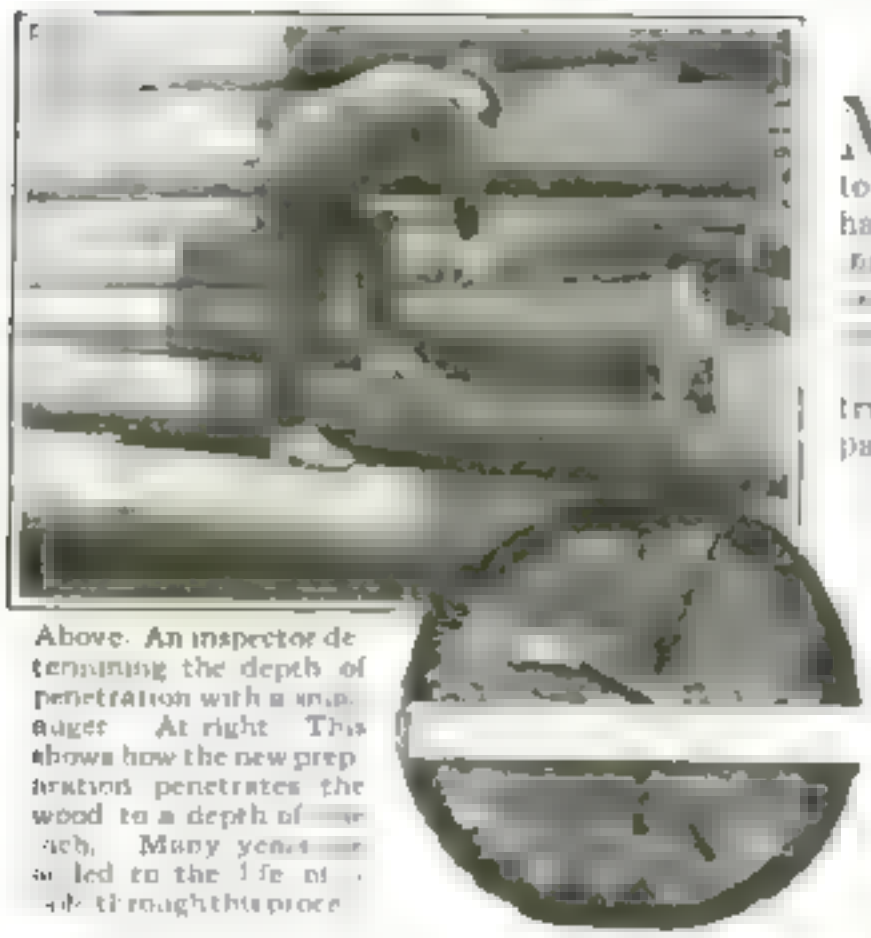
Whenever the compass bowl is turned, the amount of the turn can be read from the indicator, the deflection of the hand being the greater as the deflection from the course is greater. In fact, by beveling the edge of the diaphragm, a gradual increase or decrease of the intensity of illumination corresponding to a given rotation of the compass bowl, that is, an increasing or decreasing electrical resistance of the selenium cells, is obtained. Any airplane or seaplane fitted with this arrangement can accordingly be steered accurately in a given direction, any deflection being equivalent to a rotation of the compass bowl with regard to the magnet system. In fact, the pilot has but to operate the vertical rudder to the right or left, according as the course indicator is deflected to left or right.

If now the compass bowl be turned through a certain angle, say thirty-five degrees, relatively to the longitudinal axis of the airplane, the pilot has only to fly according to the course-indicator in order to cause the new course to deviate thirty-five degrees from the initial direction, one of the selenium cells being lighted until it is brought back into the shadow of the dial diaphragm by turning the airplane round through the same angle.

Fire-Fighting with the Help of Wireless

With the aid of radiotelephony, a fire chief may now sit in his office and give directions to the various units of his department. Every station will have a radiophone, and—as shown in the picture above—one truck of each company will have portable equipment

A single wire is used for the antennæ. In the center picture a fireman is attaching this to a lamp-post. It may also be attached to a telegraph-pole or a tree. The right-hand picture above shows a crew of radio firemen getting ready for their work



Above: An inspector determining the depth of penetration with a spiral auger. At right: This shows how the new preparation penetrates the wood to a depth of [illegible] inch. Many years [illegible] led to the life of [illegible] through this process

This Preservative Keeps Telegraph-Poles Fit

THE butt of a telegraph pole decays rapidly unless it has been treated with a preservative. The pole butt rots away, and with the first severe wind-storm down comes the pole. Not only does this cause interruptions in service, but it also costs the telegraph, telephone, and electric companies large sums of money, not to mention the accidents to human beings and animals.

Chemists searched long for a really good wood preservative. A good preservative was found, but there remained the problem of making it penetrate the butt of the pole under treatment. A mere "skin" penetration is not sufficient. A number of different processes have been used, with no startling success.

A solution is found for every problem. A new process has been perfected that places absolute control over the penetration of preservatives into telegraph-pole butts.

Heretofore, much of the trouble has been caused by unequal penetration. Treated poles often came out of the process with complete penetration on one side and partial penetration on the opposite side. The new method brings about complete and uniform penetration for a distance of from one half to one inch.

A pure coal-tar distillate is used that prevents the injurious bacteria and fungi getting into the wood. The preservative is forced into the pores of the wood under pressure.

This development may appear somewhat trivial to the man in the street until he learns that this method of pole preservation will save more than twelve thousand acres of forest a year. It will do much toward the conservation of our national woodlands.

Moving Rolls with Electric Trucks

MECHANICAL handling has progressed to the point where special handling machinery is being developed for the [illegible]

truck [illegible] paper rolls

A scooplike arrangement is placed on the front of the truck. This slides under the floor. The [illegible] itself under the roll, the [illegible]

This truck was made especially to handle large, heavy rolls of paper

The scoop drops down, passes under the paper, and lifts it up

a motor circuit, and the paper is lifted clear off the floor and held ready for transportation. The gears are shifted, and away goes the heavy roll to another part of the paper-mill or printing-plant.

A half-ton roll of paper may be lifted and carried to any part of a plant without being touched with the human hand.

The lifting scoop is arranged on a swivel so that the roll may be turned and set down on its end, should that way be more convenient.

Plywood—Stronger than Natural Wood

WOOD has always been an interesting object of study. With the advent of the airplane the study has become much more intense.

The pictures show experts of the Forest Products Laboratory, Madison, Wisconsin, making a study of veneer and plywood.

Strips of veneer—sheets of wood cut from the end or face of a revolving log—are fastened together, forming the plywood, used in the manufacture of engine bases and other parts of airplanes.

A broad, thin sheet of veneer would soon split if required to support any great weight. Fasten two or more sheets of veneer together, however, with the grain of the wood running in different directions, and the danger of splitting is largely overcome. The veneer can also be fastened together so as to help overcome warping of the wood from moisture, something to avoid in airplanes.

Tests were made with thirty-five different woods to develop the best plywood for airplanes.

A report prepared by the National Advisory Committee on Aeronautics, at Washington, D. C., ought to be read by every manufacturer, for plywood can be used to make trunks and other receptacles.

Screw fastenings of the plywood are used among the various methods of testing. The force required to tear through the wood is measured and the strength of different kinds of wood is tried

The strength of the plywood is tested by the splitting method. The veneered block is attached to the end of a sharp pointer and a gage measures the force required to split the block

Cut the Hauling Cost by Portable Machinery

GETTING material from one place to another in a short time—that is the secret of industrial efficiency today. Here is a machine that will get coal, stone, or other materials from one place to another on short order

It is a portable belt-conveyor arranged to travel on a railroad track. A powerful electric motor keeps the big belt in motion. Material placed on it is conveyed rapidly to its destination, where it falls off the belt into a chute. When the belt is loaded down, it comes to rest on the pulleys underneath. These are arranged in a semicircle on the bunker to accommodate the belt.

Tons and tons of material may be shifted from one place to another in a very short time with this new conveyor. The motor is also used to move the machine about.

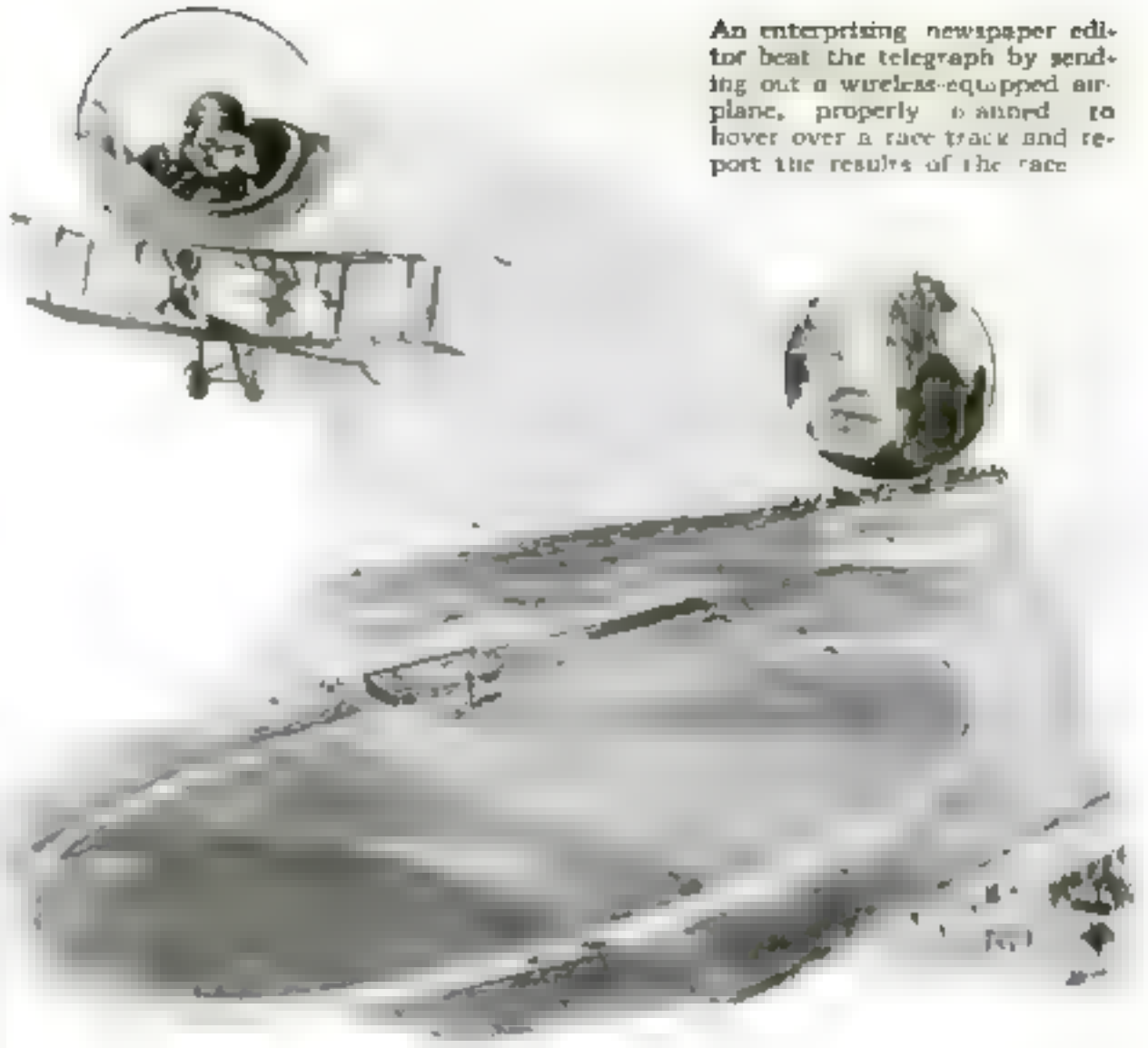
A portable belt-conveyor that will get material from one place to another in record time

Turning Motor-Cars into Railroad Trains

TAKE the rubber tires off an automobile, put in their place iron car-wheels, and you will have a railway motor-car that will follow the car-tracks just as well as a steam or electric locomotive.

The chief objection raised against the use of automobiles for railroad work is that an automobile can't travel backward at a high rate of speed. Thus when it reaches the end of the line it has to be turned around. But if you fasten two automobiles back to back, you don't need to worry about turning them around. The cars take turns acting as trailers and, incidentally, accommodate twice as many people.

Such a dual train is shown herewith. It will carry fifty passengers and will cover about one hundred and fifty miles a day. Both cars have two pairs of front wheels.



An enterprising newspaper editor beat the telegraph by sending out a wireless-equipped airplane, properly manned to hover over a race track and report the results of the race

Radio and Airplane Win Newspaper Scoop

A NEW factor has entered into newspaper reportorial work that may revolutionize the whole business.

Heretofore horse races, automobile races, and other events have had to be reported to the newspapers by telegraph. Now an enterprising London newspaper has gone the disciples of Morse one better. Recently a horse race took place at Ascot in which all England was interested. So the editor of this newspaper decided to have the race reported from an airplane, not only because it would be a distinct novelty to publish the story as being aerially reported, but also because he thought he could in this way actually beat the telegraph.

He engaged a plane with a pilot and a wireless operator and sent them out to hover over the race-course and report what they saw by wireless direct to the newspaper office. No doubt he got the idea from the work of the reconnaissance planes during the war, which directed the fire of the gunners far back of the lines by wireless.

The aviators were a distinct success. They were able to follow the racers around the track, reporting in detail the position of each at various distances, and sending a vivid story such as no observer stationed in the grandstand could give them. The plan was eminently successful.

Two automobiles with iron wheels, fastened together back to back make an excellent railroad train. The two cars act alternately as trailers

Hammering Water to Drive Machinery

The startling new invention of Constantinesco

THROW a pebble into a pool of water. Waves ripple out in every direction. These waves are power waves; for the pebble suddenly displaced the water—pushed it away.

This has been known for centuries. But it has remained for a brilliant inventor, Mr. George Constantinesco, to apply waves to the actual driving of machinery. His invention must be regarded as one of the most startling made in our time.

He is carrying the piping used for a rock drill

The waves in pools dissipate their power. They spread out rapidly in all directions. But suppose they could be set up in a pipe full of water. And suppose, further, that they were set up anew constantly by some device. That, in brief, is the essence of Mr. Constantinesco's invention.

Mr. Constantinesco's ideas have been carried out practically in various mechanical forms by Mr. Walter Haddon and Messrs. W. H. Dorman and Company, of Stafford, England, for which reason English engineers are beginning to speak of the "Dorman system." The accompanying illustrations show these practical applications so clearly that the reader has only to refer to them to learn how waves of water in pipes can drive such machines as rock-drills, riveters, and motors in general.

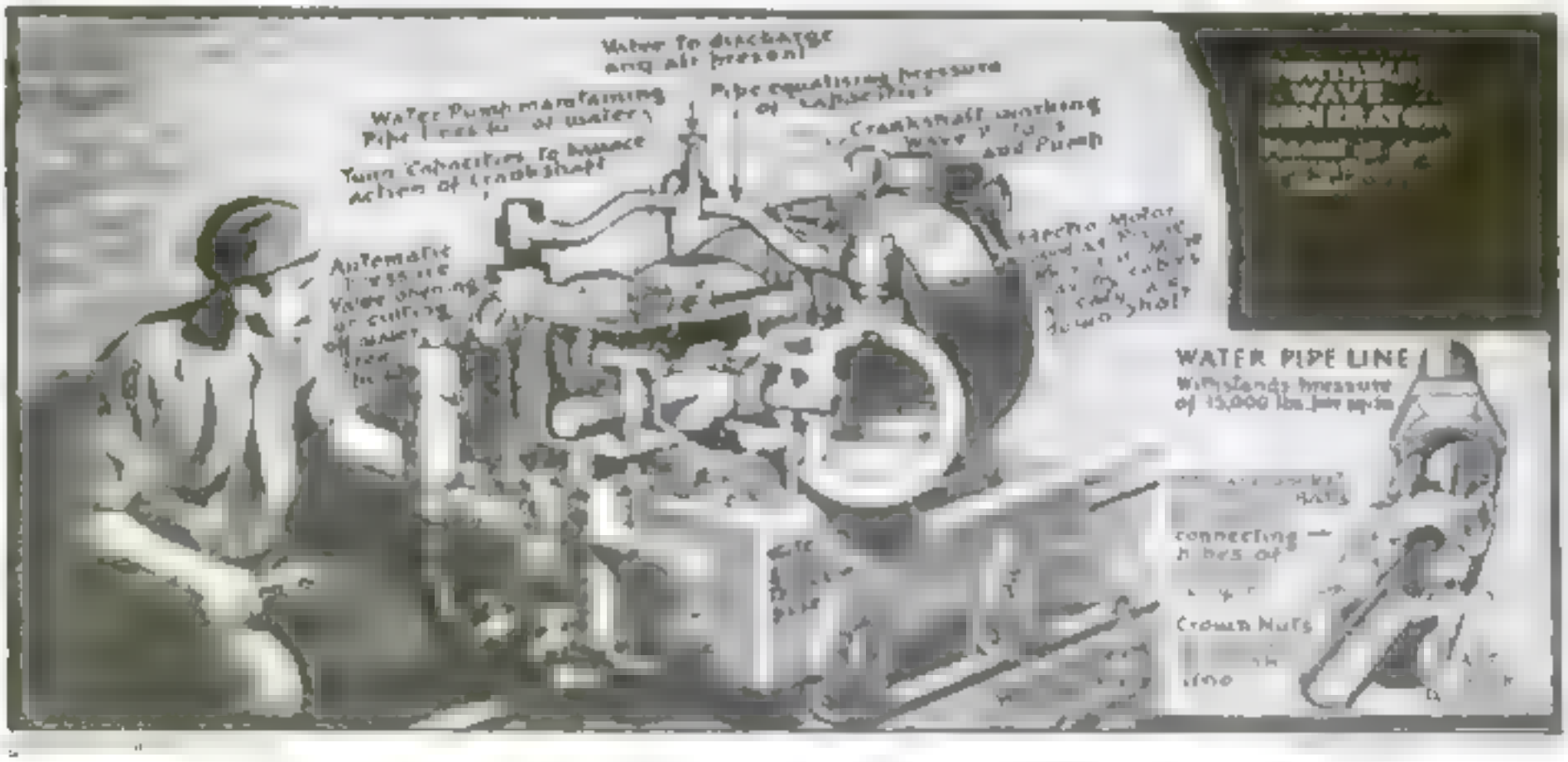
Water, as everybody knows, is practically incompressible. But not every one knows that it is also slightly elastic. Because it is elastic Mr. Constantinesco's ideas are practical.

Suppose a water-filled pipe is sealed at one end. At the other end is an engine, a "generator" of waves. The generator has a piston, which strikes the water so many blows a minute. The usual slow-moving piston would compress the water elastically through the entire length of the pipe, so that it would all be under uniform pressure.

This hammer-piston does not act in this way. Each blow sets up a sudden impulse. Near the piston the water is suddenly compressed. A little time elapses before the wave of compression is received by the water in the far end of the pipe. Hence there is a high-pressure zone near the hammer-piston; then a low-pressure zone; next a high-pressure zone. So high- and low-pressure zones alternate, until finally the blow is received at the end of the pipe. These high-pressure zones correspond with the crests of the waves formed when a pebble is thrown into a pool of water; the low-pressure zones with the valleys. At the end of a sealed pipe the wave is, of course, reflected back again.

It is evident that the power impulse that is reflected back in a sealed pipe must not interfere with another forward impulse set up by a blow of the piston. Start a pendulum swinging, and you can keep it heating with the slightest tap of the finger—if the tap is timed correctly. Unless the tap is applied at just the right instant, the pendulum may be stopped.

The wave impulses in the sealed pipe act like a pendulum. The blow struck by the piston must fall on the water at the right instant. Hence, if the blows of the piston are timed correctly, the

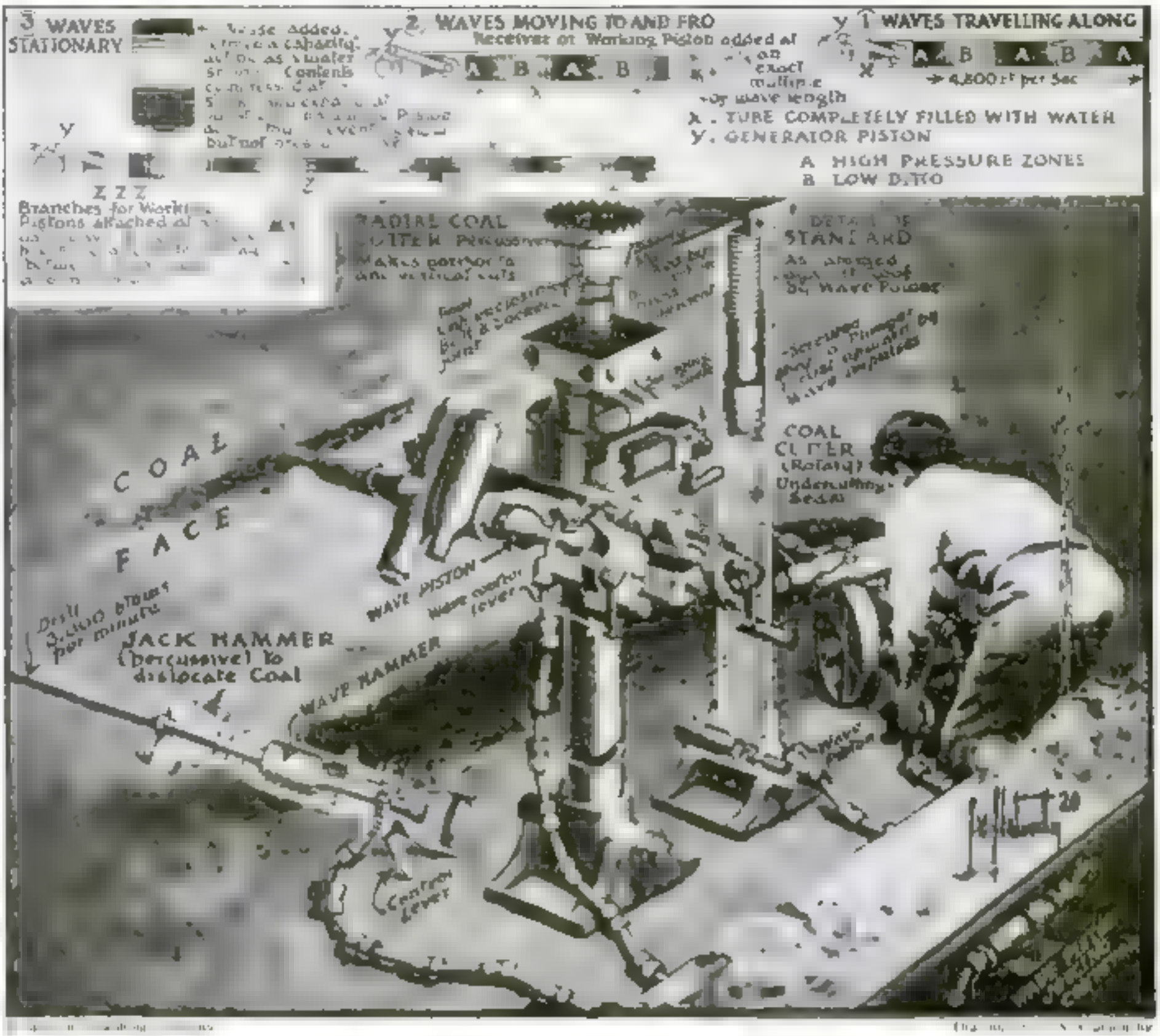


How Power Is Transmitted through Pipes Filled with Water

At one end of a pipe filled with water is a wave generator here shown; at the other end a piece of machinery to be driven. The wave generator is simply a device to hammer the water in the pipe periodically. The hammering sets up power waves in the water, and these waves drive the machine at the other end.

In order that several machines may be driven as they are needed, and therefore not necessarily simultaneously, "capacities" are introduced. The purpose of these is described in the article.

The pipe that connects the capacities has an air-release valve, and so has every tool or motor driven. If trapped air were not released, it would create surges and affect the water pressure.



How Tools Are Driven by Water Waves Set Up in Pipes

The principle by which water is hammered in order to set up power waves to drive machinery is here shown. The hammer takes the form of a piston that has a stroke of less than an inch and a diameter of slightly more than an inch and a half

The wave generator containing the piston is driven either electrically or mechanically. The waves travel at the rate of forty-eight hundred feet a second. A generator speed of forty revolutions a second gives a wave-length of one hundred and twenty feet

The maximum pressure is usually fifteen hundred pounds to the square inch, and the average seven hundred and fifty pounds. Water in the pipe cannot freeze while it is being hammered

high- and low-pressure waves of the reflected impulses will coincide with those of the forward impulses. In other words, a reflected wave reaches the piston again just as a new blow is to be struck. If the pipe is sealed at the far end, as we have been assuming, the power of the waves would be multiplied until finally the pipe would burst.

But the pipe is not sealed. Instead, it is connected with some form of motor that is driven by the impulses. Still, correct timing of the blows is essential. The wave generator (piston) and the motor at the other end must run in harmony, so the blows will be delivered at the right time.

It may be difficult to understand why a sudden blow of a hammer piston on water should act differently from the slow push of an ordinary piston. Suppose that you have a row of bowling-alley balls in a runway, each ball in contact with the next. Then suppose that you were to strike the first ball a blow. The shock would be transmitted to the last ball. Only that ball would move; the intermediate balls would remain practically stationary. A power wave has been transmitted from the struck ball to the last.

The Dorman wave-power system works on this principle. It is more convenient and more efficient to use a liquid like water, which completely fills a pipe, than a series of balls or some solid substance.

Wave power is also transmitted by a carpet when you shake it in the right way. Pick it up by one corner and give it a quick up-and-down movement. A wave travels to the outermost edge of the carpet; yet the carpet as a whole is not shifted from its position. So it is with the water in the pipe of the Dorman system.

A pipe line can be branched so as to serve a number of machines. Each machine is so placed that it receives impulses at the right time. The engineer in his technical parlance says that it is stationed at an exact number of wave or half-wave lengths in the

line. A motor inserted at the wrong place (a quarter or three quarter wave length) would not work

Running Several Machines

Suppose that all these machines are not working at once. Does this render the whole system worthless? Not at all. What is called a "capacity" is introduced into the main pipe. The "capacity" is merely a chamber. At each blow of the piston the water in the capacity chamber is compressed, only to expand again between blows. It acts, therefore, as a kind of spring to absorb the surplus energy and give it back between blows. Thus the wave generator is called upon to perform work equal to the energy utilized by the machines actually in operation.

A typical ten-horsepower generator rotates at a speed of twenty-four hundred revolutions a minute, which means that forty wave impulses are set up each second. That the piston is really a kind of hammer is shown by the fact that it has a stroke of only 29 32 of an inch, and a diameter of slightly more than 1 9 16 inches.

Although in field plants it is simple enough to take a branch at a point that will bring a rock-drill to within a multiple of an exact wave or half-wave length from the generator, in factories and buildings, where space is of importance, surplus lengths of piping might be inconvenient. A simple device known as a condenser is therefore used It consists of a short cylinder of a larger diameter than the pipe, which is inserted in the main at any point desired. In this cylinder is a free piston, upon one side of which the waves strike and which in turn passes on the impulse to the water on the other side of it. Normally the piston is maintained centrally in the cylinder by a spring on each side. From this cylinder a branch is led to a machine, and as the cylinder serves as a "capacity," it may be inserted in the pipe main when necessary.

Water the Sole Requisite

The importance of this apparently small detail cannot be exaggerated. It makes it possible to place a motor anywhere—even in close proximity to the generator—so that wave-power transmission is not limited to long distances

Not the least astonishing feature is that water can be drawn off at one end of a pipe main and replenished at the generator end while the plant is at work, without affecting the efficiency of the wave transmission. Thus water for rock-drills is taken from the pipe mains.

How to Become Transparent

A peculiar liquid that renders flesh invisible

WHEN you look at the bony bat and arm below, you think they are X-ray pictures, taken by an X-ray machine. But that is not so

The arm, for instance, is a real flesh-covered arm immersed in a liquid that has certain refractive properties that make the flesh invisible. The picture was taken with an ordinary camera.

This peculiar liquid that renders things invisible, or rather transparent, was invented by Dr. J H Stean, of Worcester, Massachusetts. What happens? The liquid has the same index of refraction as the flesh. By this we mean that the light rays passing through the liquid are not bent, or refracted, when they pass through the flesh of the arm. Thus the flesh becomes invisible.

To further illustrate this, take for example a glass tube. When you hold it in the air it is plainly seen, since the light rays passing through the atmosphere are bent on entering it If you place that glass tube in water it will not be nearly so distinct as when in the air. The index of refraction of water is almost the same as that of glass; thus the rays are bent very slightly when they pass from the water to the glass.

Different parts of an animal's body have different indices of refraction, but it is possible to make any part disappear by submerging the animal in the proper liquid. A good mixture for making flesh invisible is three parts of salicylic methyl ester and one part of benzyl benzoate.

© Keystone View Company

This is not a skeleton, but a picture of a real, flesh-covered bat that has been immersed in a liquid that makes its flesh invisible

© Keystone View Company

This arm was in a liquid with the same index of refraction as flesh

"Dynamite Wilson" Jumps from the Clouds

Four miles he dropped, held up only by a little silk parachute

By Lieutenant C. P. McDarment

HOW does it feel to step out into space about four miles above the surface of the earth with a small silk parachute that is not guaranteed to open in the thin atmosphere existing at that altitude? Only one man in the world at the present writing has had this remarkable experience. He is Second Lieutenant John H. Wilson, of the United States Air Service, member of the 96th Aero Squadron, better known by his army name of "Dynamite" Wilson.

Lieutenant Wilson obtained permission to make a parachute leap from twenty thousand feet. At 4 P.M. on the seventh of last June, after spending half the day in inspecting and folding his "chute," he started up in a D. H. 4B bombing-plane piloted by Lieutenant Delmar Dunton. They climbed in circles for about an hour until the instruments registered higher than twenty thousand feet.

It was a hot Texas day below, but at that altitude it was freezing cold. Lieutenant Wilson stood on the edge of his seat shivering with cold, and when the pilot slowed down the motor a little, he made a powerful leap backward and cleared the wires of the ship.

Like a Rock He Dropped

According to his statement, he dropped like a rock through the cold, rare atmosphere, at the same time pulling the release mechanism of the parachute. After an unusually long time, and as he was about to pull the release of his second or emergency parachute, which was carried to be opened near the ground to further break the fall, the wind caught the folds of silk and brought the lieutenant up with a heavy jerk. The threads *held!* It had been doubtful whether the material would stand the strain of the check after so much momentum had been gained

In the first few minutes after the parachute opened, Lieutenant Wilson could feel no apparent motion in either direction. He seemed to be suspended motionless in mid-air. But not for long Suddenly a gale of wind caught him and carried him many miles at great speed; then another gale, blowing in the opposite direction, caught him and blew him back as rapidly.

Freezing gales in the thin atmosphere tossed Lieutenant Wilson about like chaff. Sometimes he spun on the edge of the vortex of a mighty whirlwind into which he would drop

The winds appeared to be in a turmoil. The parachute was banged around at all angles. It was even turned over so that it "looped." Sometimes he would find himself spinning on the edge of the vortex of a mighty celestial whirlwind into which he would presently fall like lead for hundreds of feet.

Only Seventeen Minutes!

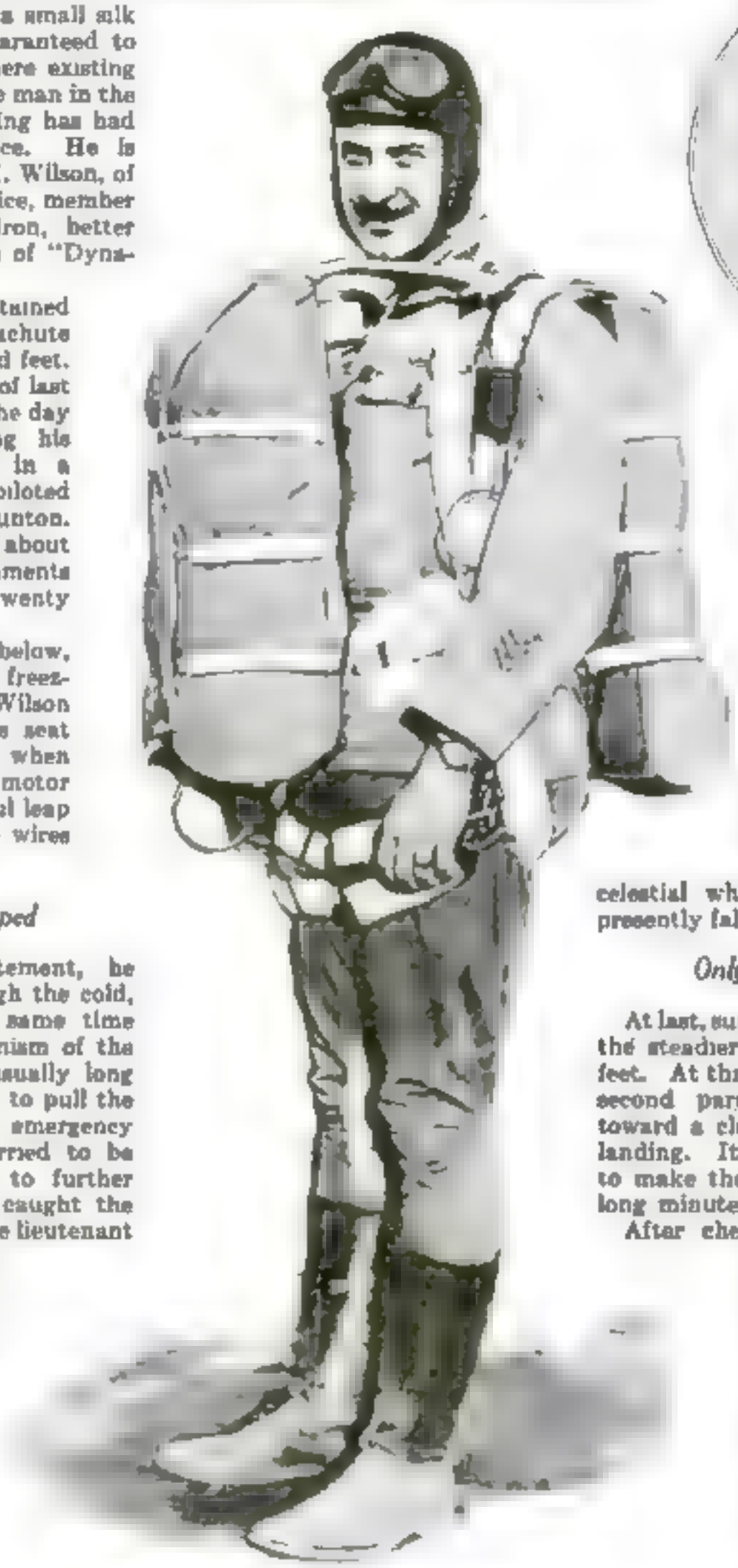
At last, suffering from nausea, he reached the steadier winds around five thousand feet. At three hundred feet he opened the second parachute, and began working toward a clear field, in which he made a landing. It took just seventeen minutes to make the descent. "They were extra long minutes," says Wilson.

After checking up the self-registering instruments that were carried aloft sealed, it was found that the exact altitude was 19,861 feet. This was a few feet less than was intended, but it broke the world's record by more than a mile. The extra mile was the mile in doubt. It had been questioned whether a parachute would open at that altitude.

Except for a nausea that soon wore off, the lieutenant did not suffer physically.

"Why did you take two parachutes?" asked someone.

With a twinkle: "One might have worn out."



Lieutenant John Wilson, who at a height of four miles stepped overboard from an airplane into space. Before his parachute opened, he dropped for some distance through the air like a rock Because of a noticeable liking for dangerous adventures of this kind, his friends call him "Dynamite Johnny"

The bricks made of cinders are smooth-faced and porous. Thirty-seven thousand of these bricks can be turned out under pressure in one day

Houses Built of Cinders

WHAT becomes of the ashes and cinders that every morning you shake out of your grate or furnace? What becomes of the piles of slag accumulated in the vicinity of iron or steel works? These and other waste materials can be turned into valuable building material if a plan that has been started abroad is followed.

During the shortage in building material it was discovered in Europe that waste, such as cinders, slag, lime, and coal, from which the gas has been extracted, can be pulverized and compressed into bricks. Combined with certain hardening substances, they furnish excellent six-pound bricks, smooth-faced and porous.

The bricks from waste can be made rapidly, the product of one plant being more than thirty-seven thousand bricks a day. When one considers the amount of waste accumulated around gasworks, furnaces, and other industries, the value of the waste utilized in making bricks can be realized

Here is a house finished with concrete over the outside of the cinder-made bricks

Two Bubbles at One Blow

PIPES for bubble-blowing are now specially made One of those shown herewith is so constructed that it will blow two bubbles at the same time. Instead of being bowl-shaped, the end of the pipe is shaped like a tea-strainer. When you wet the end with soap-water and blow, one bubble will come out of the top and another out of the bottom

But there is another blower that eliminates even the bowl of soapsuds. It is a tube, open at both ends. In one end you fit a specially prepared tablet of soap which has a hole in the middle. You blow through the other end. All you need do to produce a bubble is wet the tablet of soap. When one tablet wears out, you insert another.

The tablets are made so that they will expand after they have been inserted, and fit tightly. First the right kind of soap is made; then it is artificially dried and broken up, next it is combined with powdered sugar and olive-oil soap containing caustic soda.

In our youth we were glad to have a penny clay pipe for bubble blowing, the modern child demands a pipe that blows two bubbles

Making a Trailer of the Airplane

HERE is a miniature airplane that can be towed through crowded city streets without interfering with traffic. The airplane is designed to be folded down rapidly as well as to be quickly made ready for flying.

When folding down the airplane for transport, a wooden stay pressing against the keel pin is loosened, after which the horizontal rudder is swung upward. By turning a handle at the top of the tightening tower, the cables of the supporting planes are loosened, allowing the planes to be removed.

You do not have to remember names at conventions where the delegates wear these badges

Wear a Badge and Save Introductions

"I DON'T remember your name," you stammer, as you try to introduce two fellow delegates at the convention you are attending. The man mumbles his name; you don't like to ask him to repeat it and you continue to talk, not knowing to whom you are talking. Should you meet again, you would have to repeat the process. Would it not be better if each delegate wore some sort of identification tag? Introductions would then be unnecessary

Strangers attending conventions will find it easy to get acquainted with one another if they wear the identification badge shown in the photograph.

When the wings are folded back, they will not exceed the width of a motor-car's chassis. A strut is inserted into a clip at the rear of the motor

Road-Builders Make Use of the Turntable

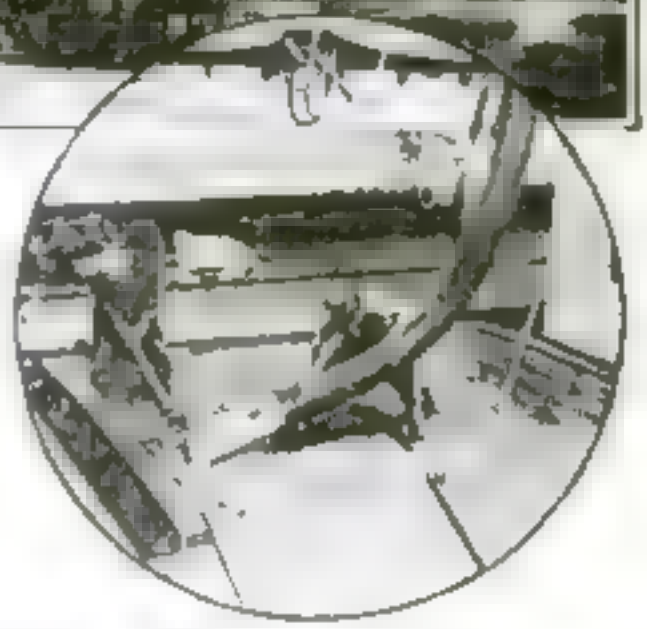
HERE is the idea of an ingenious contractor. Like all other contractors who undertake to build long stretches of concrete road he was confronted with the transportation problem, particularly that of turning his trucks about after they had deposited their load of wet concrete.

The road was only eighteen feet wide. Even his little tracks could not make this sharp turn without considerable trouble and loss of time. Hence came the idea of a turntable.

The turntable was made and brought to the scene of action. It worked like a charm. The cars were placed, two husky men gave them a twist, and they were off after another load. Congestion was prevented and the work was speeded up. A small tractor is kept on hand to pull the turntable forward as the road grows.

Turning a truck around in a hurry. With a road too narrow for rapid turning, a turntable is used

A load of copra is sucked into a big pipe from the ship and blown into box cars



The air pipe that feeds into the cars is swung away to let cars waiting on a side track near by

Unloading Ships by Air

THE old hand shovel is losing its place in industry. The endless belt-conveyor and the compressed-air system are fast replacing the back-breaking shovel. Now they are using compressed air to unload ships at Oakland, California.

Several big pipes are brought on to the ship, the heavy compressors are started and the load begins to move shoreward at a lively rate. It is lifted high in the air, shot over the railroad tracks and building into the siding. The cars are pulled away as fast as they are loaded.

The pictures show copra being sucked into the big air-pipe. It is the duty of the two men in the lower picture to guide the pipe and keep the material loose, so that the pipe can pick it up and whisk it away to the waiting cars.

Air under pressure travels very fast, in some cases even reaching a speed of several miles a minute.

Shave with Revolving Blade

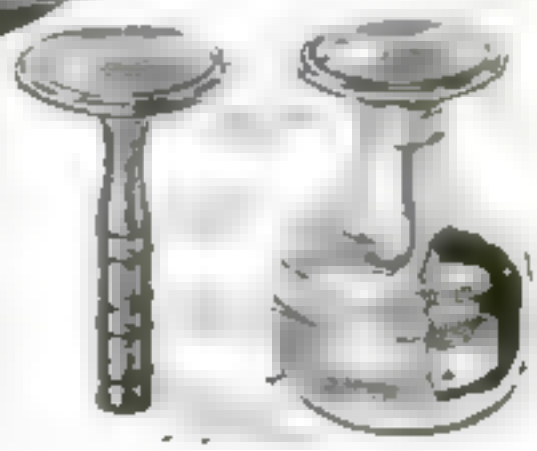
NOW there appears a razor whose blade is circular and made to revolve by means of a spring inside the handle. The blade is protected by a guard that rests against the face and keeps the skin taut.

As you draw the razor across your face, the revolving blade is given a double motion. Thus it cuts each hair diagonally.

The jerking and pulling caused by the straight razor stroke is eliminated when the circular blade is used, and there is no skin soreness afterward. You can work rapidly with the new razor and "once over" should be enough.

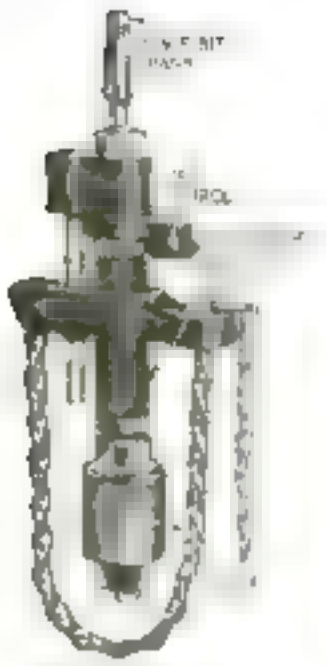
Compare the act of shaving with that of cutting bread, and you will see the merits of this razor blade. When you cut bread, you move the knife downward and diagonally at the same time; that's how you get a clean edge. But should you try to cut a slice by downward pressure alone the bread would resist and the edge cut would be ragged.

He is shaving with the revolving razor. It has a double motion, insuring a smooth, quick shave



The revolving blade is actuated by a spring inside the handle and is protected by a guard that rests on the face and keeps the skin taut

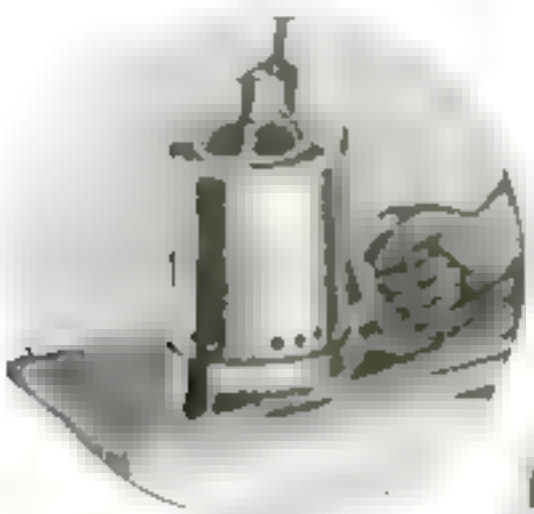
Do It with Tools and Machines to Get the Most Efficient Results



This little drill has an automatic friction and ratchet feed. It saves time that would be otherwise consumed in adjusting the feed of the drill. It also helps to save the drill points

When castings are made, the heat of the molten metal bakes the sand core into a solid mass. These compressed-air tools dislodge the sand in short order

One man may exert a lifting force of four thousand pounds with this jack. It has no bearings, gears, or pulleys and weighs but seventy pounds. It is manufactured of forged steel



The draw-shave and the rasp are out of date now. This electrically driven edge trimming machine works faster and better. It consumes little power and requires absolutely no skill to operate

This heater keeps the tools hot that are used to finish the edge on your shoes at the shoe factory. The tools are placed in the holes

Taking the place of a hook, this clamp will grip metal sheets and plates. It bites into them and automatically releases itself

A bearing can be babbitted in a jiffy with this tool. It is especially designed to re-babbitt connecting-rod bearings for automobiles. Wooden mandrels of different sizes are supplied with it

A vise that has a handle attached to it so that the machinist may drill small pieces without fear of their turning around with the drill. It prevents battered knuckles

An electrically driven rubber that does the work of three men. It puts a piano polish on wood and has only to be guided over the surface

This hood over the soldering copper carries away all dangerous fumes and protects the operator from lead poisoning. A suction is created by a motor fan

Keeping Up with the March of Science

Facts for the man who wants to know

This Glass Is Half Lead

X-RAYS cannot pass through lead. They do, however, pass through ordinary glass with perfect ease. The early X-ray tubes were made of ordinary glass. As a result, many people received burns by exposure to the rays, which are tissue-destroying.

The new Coolidge X-ray tubes are made with a glass that contains considerably over sixty per cent (by weight) of lead. The glass is fully transparent, but slightly dark in color. It is almost opaque to X-rays and a person may stand near the tube while it is operating, with little fear of being burned. A small window of ordinary glass allows the rays to escape from the tube.

Screws Made of Beef Bones

WHEN the front and rear joint ends of beef bones are cut off and the long straight portions of the bones are boiled to remove the marrow and animal tissues, they become suitable material from which can be made the most remarkable screws.

Modern surgery can make such wonderful repairs in broken human bones that no trace of a fracture is left. The broken ends of a bone are sometimes spliced and jointed as a carpenter would fit together two pieces of a plank. It is here that bone screws are used. The strips of beef bone are cut roughly to the diameter of the screws and are put into a lathe-chuck, and with a high-speed tool used for cutting brass, are roughed out. They are then sized for threading.

Both Heater and Fan

SMALL electrical heaters have been combined with electric fans for household purposes. The heater is attached to the wire guard of the fan and when they are both in operation, the fan blows the warm air about the room. In this way heat may be distributed more quickly and the temperature of the room will be more uniform.

In the hot weather, when the heater is not needed, it may be detached so that the fan may be used alone.

Matches of Iron

IN 1803 a new metallic element was discovered and named in honor of the planetoid "Ceres," which was discovered in the same year. This rare earth metal is called "cerium" and it resembles iron in luster and color, but is soft, tough, and malleable.

The gas-mantle industry, founded by Auer von Welsbach, produces cerium in its waste products, and from the cerium, alloyed with iron, a new kind of match has been invented. It is literally an iron match. It strikes sparks. It is familiar in pocket-lighters. By turning the little wheel of the lighter, a spark ignites an alcohol wick. The iron match, which takes the place of a whole box of matches, is safe and economical.

These pyrophoric matches were used in the trenches during the war. They promise to become a popular substitute for wooden matches.

Do You Want More Food?

IF you do, your reasons should be scientifically sound.

A man's energy expenditure in his work is a measure of the food he needs. A calorie is taken as the unit; it is the heat required to raise 2.2 pounds of water from 15 degrees to 16 degrees C. The number of calories in a food must may be measured by burning it in a steel chamber known as a calorimeter.

The sedentary worker requires about 400 to 600 calories. The heavy worker may need 2000 calories. In addition, there is an internal expenditure for the average man of 1700 calories.

For two cents you can purchase about 100 calories of cheese, 200 of sugar, and 400 of bread. For a family the figures mount high.

Are Potatoes Too Dear?

HOW much does it cost to get potatoes from the farmer to the final consumer? The cost is not known. Estimates have been made from time to time, but they were—just estimates. It is only recently that the Department of Agriculture has decided to get facts.

A committee has been formed to find the cost of bringing potatoes from the field to the table. It is a bigger problem than most people think. Wages, transportation, waste, storage, crating, etc., enter into the calculation.

Tooth Solvents for Dentists

LOOKS as if all the joy of life were going to leave the dentist. He isn't going to be able to use his best instrument of torture much longer.

Instead of boring out teeth in the usual painful way, he will use a "tooth solvent."

This is an acid of organic derivation that will dissolve the decayed portions of a cavity. Simply by dipping a tiny swab in the liquid and applying it to the surfaces to be removed, both dentine and enamel can be painlessly taken out.

It has been estimated that this advance will reduce the cost of dentistry something like fifteen per cent. Who can estimate the number of persons who will now cheerfully submit to dental work?

Wealthiest and Biggest

THERE are now nearly six million people in the city of New York, and it is the largest center of population on the globe. It is growing faster than London at the rate of nearly two to one, London doubles its population every thirty years and New York every eighteen years.

New York's cash balance demands a sum of more than thirty million dollars, and it is the wealthiest city in the world. In fact, its total assessed value is greater than all of the United States west of the Mississippi, and its income exceeds that of twenty states combined.

Every nineteenth American lives in New York city, and one tenth of all manufactured products is made there.

There are twice as many theaters in New York, and three times as many hotels as are in London.

Glass that Heat Can't Break

ORDINARY glass is very sensitive to temperature changes of a sudden nature. A drop of water on a hot lamp-chimney is very apt to set up strains that will result in instant fracture.

A glass is now manufactured that is absolutely immune from sudden temperature changes. Two semi-metallic substances enter into its composition that have different points of expansibility. A tube is made from each of the two glasses. The tubes are then placed one within the other and fused together. A very rugged glass results.

A Tribe that Eats Its Dead

DURING a recent expedition into Africa, into the country lying west and north of Lake Victoria Nyanza, John Roscoe, lecturer of Cambridge University, made some interesting discoveries. He found some tribes who ate their dead, no matter what the disease that took them off. Even smallpox victims were not considered unwholesome, consequently this particular tribe was one of the unhealthiest in the country.

The Ghost of a Ghost

SEVERAL telephone or telegraph messages can be sent on the same wire. This is called use of a "phantom" line.

This theory is now being applied to wireless. But wireless has no "line" to start with. Thus we have the phantom of something that is really non-existent, the ghost of a ghost!

For incoming messages the system is to have several receivers, each of which can be "tuned" to a separate wave length agreeing with that of the sender.

Outgoing radiations, however, require

great application of energy to the antenna. Difficulty of duplication has always been that only a destructive conflict is set up by applying more than one source of oscillation.

There is now being developed a series of inductively connected electric "vibrators" that will make it possible to send as many as one hundred long-distance messages from the same radio set.

Oil from Earth and Sand

OIL-GUSHERS flood the surrounding ground with oil. It forms small lakes and pools and it is taken from these and placed in barrels. When the oil is allowed to stand for a great length of time, some of it soaks into the ground.

Experts from the Bureau of Mines have been considering the advisability of recovering this wasted oil from old oil-producing sections. From data collected, it is estimated that 2,359,100 barrels of oil, valued at more than $3,500,000, could be obtained from the oil-saturated sand and earth about old oil-wells.

Timber Preserved by Damp

OAK timber will last for centuries when it is buried in water or wet sand. Oak piles that were constructed for Roman bridges nearly two thousand years ago have been found intact. In a gold-mine in Australia, at a depth of three hundred feet, pieces of oak perfectly preserved and having the appearance of having been sawed by man were found recently. The timber is in the site of an ancient river-bed.

The tough fibers of the wood evidently are strengthened and preserved by the moisture they absorb. Many other kinds of timber would rot in water, and thus would soon be lost.

The Tipless Shoelace

THE metal tip comes off a shoelace invariably when one is in a hurry. Why not get rid of the metal tip entirely? That is done in a new invention brought out by Dr. Bibard of Paris. His lace is made entirely of silk, the end twisted so tightly that no metal tip is required. To accomplish this, a special machine had to be constructed. The machine winds the silk thread tightly around the end of the lace, making a tip that is as serviceable as one of metal. It will not come off.

Longer Wires of Aluminum

ALUMINUM wire is used on high-tension electrical transmission lines because it is light in weight and offers comparatively little resistance. It is cheaper than copper and being lighter, longer spans between the poles is possible. This means fewer poles and a consequent smaller investment for a long-distance power line.

Still longer spans with aluminum wire will be made with the new steel reenforced aluminum wire that is now manufactured.

Doctoring Sailors by Radio

THE Seamen's Church Institute of New York has established a radio service to aid in the treatment of men who become dangerously ill aboard vessels that do not carry physicians.

A powerful radiophone outfit will be installed and the physician on duty will give verbal directions to the first-aid man aboard the ship.

The request from the ship will be received in code, since freight vessels have not as yet been provided with radiophone equipment. However, the ordinary radio receiving outfit is sensitive to radio voice transmission and the answer to the distress call can be made verbally, thereby saving time and insuring greater accuracy.

One Assistant: $225,000

THAT'S what New York state paid last year. But the assistant wasn't a human being. It was a tiny piece of radium.

Radium shoots out particles of matter at velocities up to 160,000 miles a second. This violent discharge is used to destroy or dissolve the diseased tissue of cancers and tumors.

A single ounce of radium contains sufficient total power to lift ten thousand tons a mile from the earth. A lump the size of an automobile could operate an ocean liner continuously back and forth across the Atlantic for two thousand years.

If a ton of radium could be collected in one spot it would be impossible to approach within six feet of the mass without instant and agonizing death.

When Is Current "On"?

IT is difficult to tell when the current is turned on or off in the case of flatirons, percolators, and other electrically heated devices.

An ingenious inventor has produced a device that will indicate whether or not the current is on or off. When the current is turned on, a small electro-magnet, which is connected in series with the device operated, is excited. This draws down a small armature, which is connected with a pointer on the outside.

The pointer reads "On" when the magnet is excited and "Off" when the current is not flowing.

Where Did Life Originate?

WHERE and when and how did life as we know it on our planet, the earth, originate?

These problems have occupied the minds of the greatest thinkers, the scientists of all ages; but a definite answer to the question cannot yet be given.

Some modern scientists believe in the possibility of biogenesis or autogenesis, and defend the theory that life originated at an early period in the geological history of our planet in a manner not yet explained; that all organic life developed by slow steps from the original protoplasm; that at first the simplest one-cell organisms were formed, which in the course of evolution developed into higher and more complicated organic complexes.

Other scientists refuse to accept the theory of the spontaneous origin of life on our planet, and maintain that the germs of life were carried here from other worlds, together with the cosmic dust that is known to be deposited on our planet at different times.

They do not explain how life could have originated on some other planet while, in their opinion, it would have been impossible for it to originate on the earth. Svante Arrhenius has pointed out that the spores of bacteria are so small that it is quite possible that they may be carried from one planet to another. In twenty days they could cover the distance from Mars to the earth, in fourteen months from Neptune, and in nine thousand years they could reach Alpha Centauri, the sun nearest to our solar system.

But granting, for the sake of the argument, that these spores could be transported through space and could endure the terrific cold prevailing in the interplanetary space—273 degrees, or absolute zero, and would not be destroyed by the total absence of moisture and the effect of the ultra-violet rays, the theory still seems to stand on a doubtful basis. It is extremely doubtful that the germs of organisms, specialized in their structure to fit a limited range of conditions, could gain a foothold and continue to live under conditions that probably are entirely different from those on the planet from which they came.

Shocks Restored His Sight

ONE English soldier, who had been blinded at the battle of Ypres, recovered his sight by nervous shocks.

The first thing that startled him was a rat that jumped across his bed in the hospital. After this incident, he found that he was able to see slightly with his left eye. A few days later, he accidentally walked into the Thames. The second nervous shock partly restored the sight of his right eye.

The physicians of the hospital were amazed. They decided to give the man electrical shocks from an induction coil. After several treatments, the man could see perfectly.

Trapping Air in Food

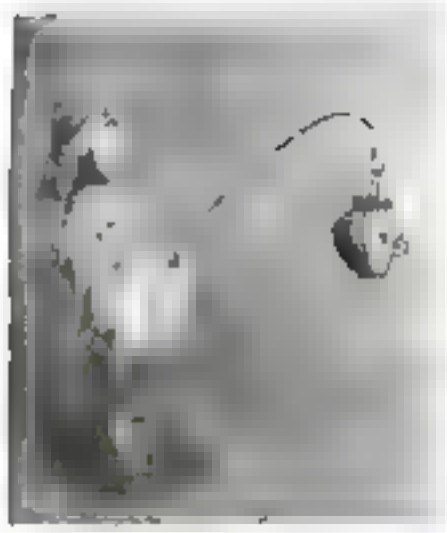
AERATION is the process of entangling air with food. For instance, when a housewife beats the white of eggs, she mixes up a certain amount of air with them that makes them foamy and fluffy. The same thing happens to cream when it is whipped.

A little electrically driven machine has been invented for the perfect aeration of food.

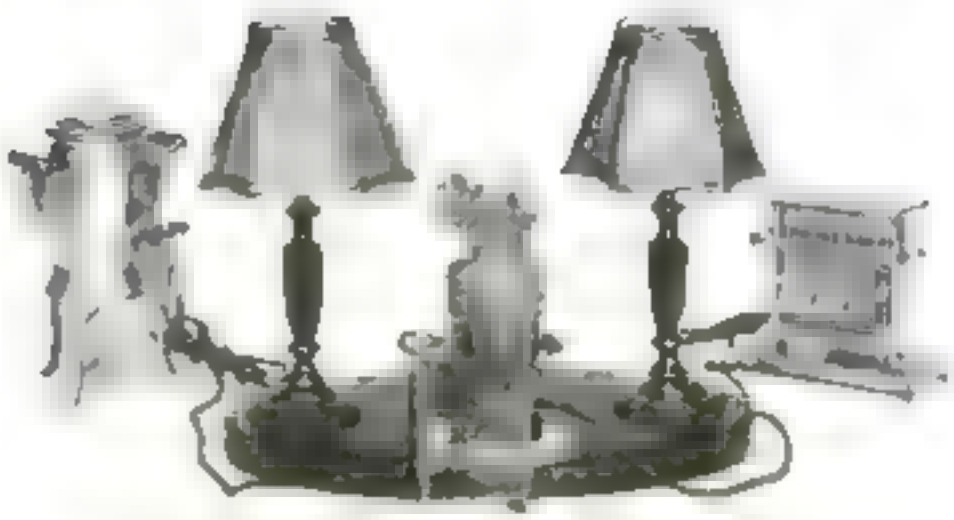
A hollow shaft bent slightly at the end is attached to a motor-shaft. This revolves in the food to be aerated. As it revolves, centrifugal force causes it to throw air off into the foodstuff. This keeps a stream of air passing down the shaft into the food.

Housekeeping Made Easy

It's the little things that count in the home



This realistic little Chinese figure carries his lantern, not for light, but to burn incense in. The incense comes in powder form and in small cone-shaped pastilles and is pleasantly pungent

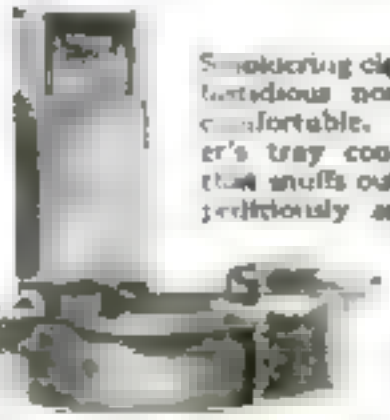


A centerpiece for the breakfast-table that is useful as well as ornamental. It comprises candle lamps, a percolator, and a toaster

This jardiniere has an inner wall, the space between it and the outer one being used to store water. Tubes in siphon shape carry the water to the growing plant

A good housekeeper is known by the spotlessness of her stove. A way to eliminate [illegible] is to burn it off with a [illegible]

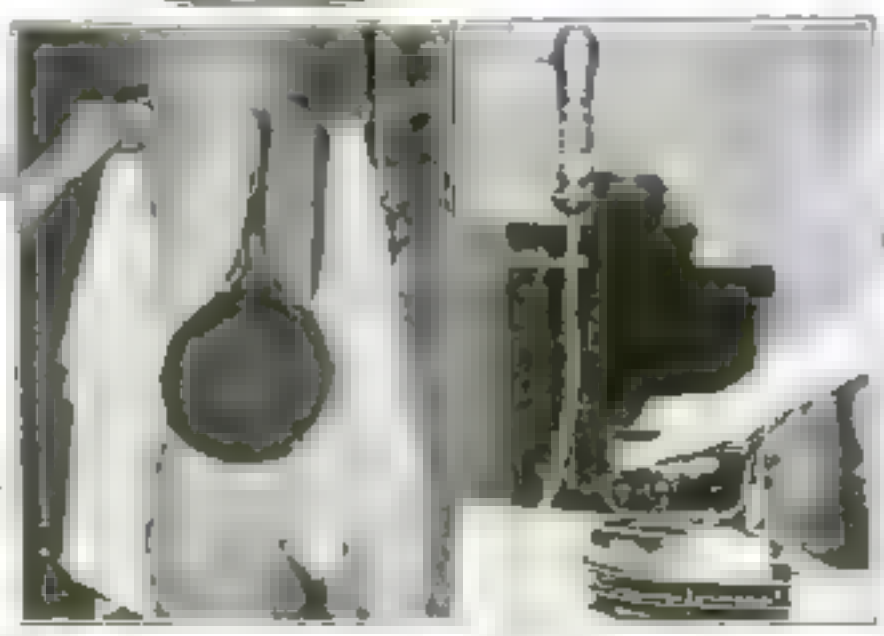
By attaching this drainer to the kitchen hydrant and turning on the faucet thus creating a vacuum, it is easy to suck out water from a wash boiler or tub



Smoldering cigars can make tiresome noses very uncomfortable. This smoker's tray contains a tube that snuffs out the light expeditiously and [illegible]

A kettle handle has been invented for protecting the hand. It can act as a shield while [illegible] to save the hand, even if the lid should [illegible]

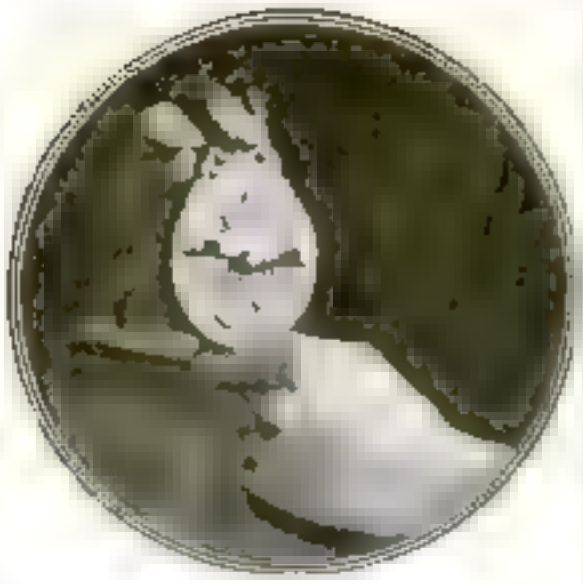
Even [illegible] attractive [illegible] wallpaper be [illegible] There is now a wallpaper with a perforated edge, which is knocked off before the roll is opened



Why waste the warm air from the boiler heater? Here is a ring that fits around the boiler from which you can hang towels or kitchen utensils to be dried

This attachment for the electric iron leaves no one in doubt as to whether the current is on or off. A small black indicator points to "Off" or "On"

Combining a knife and fork in one, this implement may be used with ease by a person with one hand. This combination would also be useful to campers



Forerunner of the Sextant—the Astrolabe

THE great-grandfather of the equatorial telescope is the astrolabe, literally a "star-taker." With it the Arabs took the positions of the stars, the height of mountains, and the latitude of a place. They also found the altitude of the sun, the moon, and the stars with the astrolabe

It consists of a disk whose margin is engraved with the divisions of the circle, and around which a pointer, or "sighter," is rotated.

When the pointer is sighted at one star and then at another, the angular distance in the sky between these stars can be found roughly.

Cleaning Castings with Sand

AN ingenious machine is used to clean castings by blowing sand on them Ordinary sand is a real abrasive substance We realize this when we think of sandpaper and its cutting power

Don't think that the sand is blown on the castings gently. Not by any means A terrific pressure is used. Compressed air picks up the sand and carries it to the castings in the big steel barrel, where it is flung against them with great force.

The sand and air are admitted to the barrel through the pipes. The rough castings are tossed about within the barrel, so that the sand will reach all parts. The metal is clean and bright when taken out

Dangerous Sledding in Switzerland

WHY do so many people go to Switzerland for the winter sports? For many years it has been the playground of Europe, but every year more and more Americans are finding it to their liking because the steep mountain slopes there are sure to be covered with snow for the greater part of the winter

In the picture above you see a sled taking one of the sharp turns on the post-road near Davos. This road is the finest natural run in Switzerland. The curves, as you see, are banked at very sharp angles Great skill in handling a sled is necessary in order to steer it safely past these curves The sled shown in our illustration is traveling at an angle of at least sixty degrees

Why don't the riders fall off? For the same reason that milk will not spill out of a pail when you swing it rapidly in a circle centrifugal force

Do Knurling with This New Tool

DO you know what a knurling-tool is? The handle of your safety razor is knurled—fine lines are cut into its surface. This is done with a knurling-tool

The ordinary knurling-tool is capable of making only knurled lines with one degree of fineness. This tool will produce several lines of different depth by simply turning the holder around so that a different set of knurling-wheels will come into position

The knurling-wheels are made of very hard steel. As they rotate against the piece to be knurled, they sink into its surface.

Two Cuts at One Time

SUCH a milling machine as the one printed below is really taking the place of a planer. It is surfacing the entire side of a large automobile crankcase in a single cut

Not only is it doing this, but it is also surfacing the bottom, since two large cutters are at work. One revolves in a horizontal plane and one in a vertical plane.

The vertical cutter can be seen at the left of the picture.

Many hours are saved on this operation by the use of these large milling cutters, time-saving that was not possible a few years ago.

Red Lights for Safety Islands

A RED [illegible] means danger to most people—even reckless automobile drivers will heed it. In [illegible] a red light has been placed at the end of each "safety island" in San Francisco as shown in the picture above. Several accidents had occurred in these [illegible] safety spots, and the very compactness of the islands are hard to see at night. But one more instance of the old [illegible] that "one man's [illegible] poison."

The red lights that now decorate these are on the regular street-light circuit and as a result go on [illegible] when the street lights do. A notable decrease in accidents has satisfied their installers.

Piano Wire Helps Astronomy

FINE wires placed across the lens of a Harvard observatory telescope and forming a screen are there for a purpose. The screen forms a diffraction grating over the lens, producing [illegible] images," [illegible] pairs of coincident lines and [illegible] from the original image of a star.

It is possible to compute the amount of light that forms these images, and to derive from the results the relative photographic brightness of the stars. By comparing these with fainter stars, it is possible to [illegible] the scale of magnitudes from the [illegible] stars whose magnitudes are known, to fainter and fainter stars whose magnitudes are desired.

It Cuts as It Traces

DID you ever draw pictures with a pantograph when you were young? Well, this oxyhydrogen torch cuts duplicate metal parts in the same way.

A drawing of the part to be cut is first made to the proper scale and placed on the tracing-table of the machine. In place of the pencil, the pantograph carries an oxyhydrogen torch, which spits forth a hissing, narrow flame that cuts through a piece of five-inch plate just as a hot table-knife sinks through butter. A small motor operates the device automatically after it has been adjusted.

As a labor- and money-saving device, this machine is a hard one to beat. It saves hours of time on a single job. It will cut through metal several inches in thickness with perfect accuracy.

The Vacuum Bottle in the Sick-Room

THE vacuum bottle that you take with you on pleasure trips will also serve you well if there is serious illness in the family.

Everybody knows how difficult it is to keep a flaxseed poultice—for example—hot for any length of time. The vacuum bottle will enable you to maintain the proper temperature of a wet dressing of any kind.

The bottle is tied upside down to the bedpost and a rubber tube is attached to the opening. The liquid at the proper temperature flows down the tube to the compress attached to the tube. A spring letter-clip, clamped on the tube near the compress end, regulates the flow.

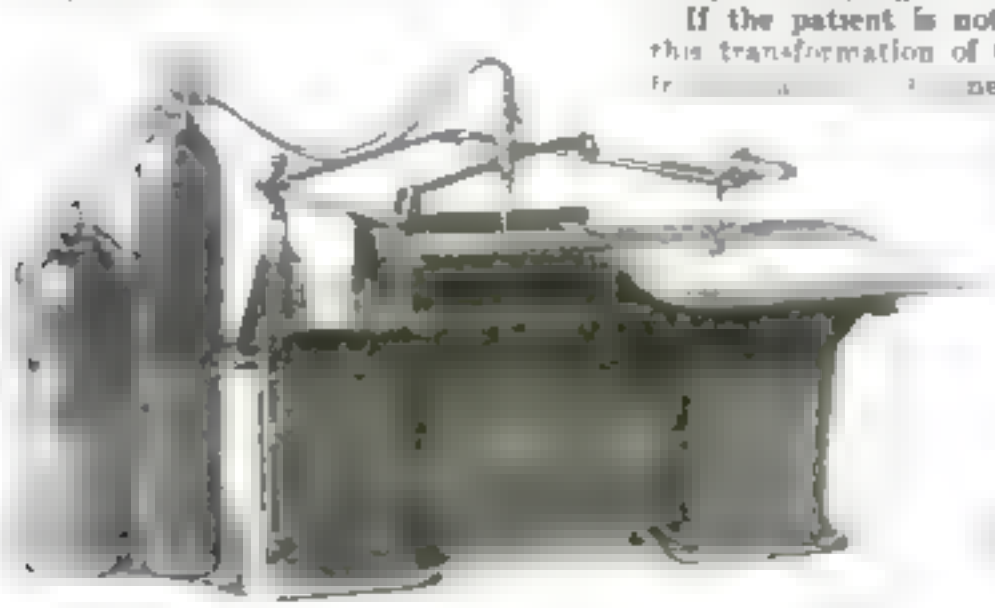
If the patient is not entirely helpless, this transformation of the vacuum bottle [illegible] nem, as it were, will enable the usually busy attendant to be about other household matters.

Pumping Air into the Lungs

IF a man falls into the river and is dragged out apparently lifeless, or if he comes in contact with a live wire and is apparently dead from shock, there is just one thing to do quickly. Get his lungs back to the business of breathing.

There are various ways of accomplishing the result. A "breathing-machine" has been invented to restore automatically the respiration. Try taking forced deep breaths for about three minutes and your lungs become tired. For forty or eighty seconds you may have no desire to breathe. This fact has been utilized in measuring the volume of air involved in the experiments tending to produce the best results.

When the "breathing" mechanism is in a state of complete collapse, only outside mechanical means will bring about a normal condition.



Feed Coal to the Fire in Bags

HERE'S a new way to [illegible] fires burning" in [illegible] creating the usual shoveling noise. Put your coal into paper bags, some day when you've nothing else to do. Then, when guests arrive and you wish to [illegible] quietly place one of your bags of coal on the grate—no noise, no dirt.

The bag burns and releases the [illegible] which then spreads over the grate automatically.

This is a very good household hint, to be passed on to the housewife.

Cleaning Streets with a "Three-Wheeler"

CLEAN streets help to make healthy cities. This little three-wheeled truck with its revolving brush will help to make it easier to scrub and brush off pavements.

The power is transmitted to the single wheel in the rear of the truck by a fifteen-horsepower motor located under the hood. The revolving brush obtains its power from the same source, and it is connected to the gear-box by a shaft with universal joints. The little truck can turn in a very small circle, which is necessary when it is at work on narrow streets.

A decided advantage of this efficient little machine is that the sweeping brush can be very quickly changed and a scraper, a squeegee, or a snow-plow put in its place, thus making it adaptable for all kinds of weather.

Up Goes the League of Nations' Radio Tower

A RADIO tower, two hundred feet high, put up in fourteen days!

This happened at Geneva, where the members of the League of Nations had their first meeting. The engineers arrived on the scene, and this steel arm started to shoot into the air at the rate of fourteen feet a day.

When the first day of the League's work was finished, the world was informed of the transactions by radio. A powerful portable equipment was set up at the base of the tower, and thus flashed the news broadcast.

Thirty years ago it would have been necessary to stretch miles and miles of telegraph wire, and it would have taken the world hours to learn the news where it now takes minutes.

Ice-Bags from Old Inner Tubes

ICE-BAGS relieve the feverish patient, but they are not large enough to cool his entire body. An old inner tube will do a much better job.

You cut the tube at the place where the valve is located. Remove the valve, tie one end of the tube tightly, and fill the tube with ice. Then tie the other end, and you will have a long narrow ice-bag that may be placed at the side of the patient or [illegible] wrapped around him.

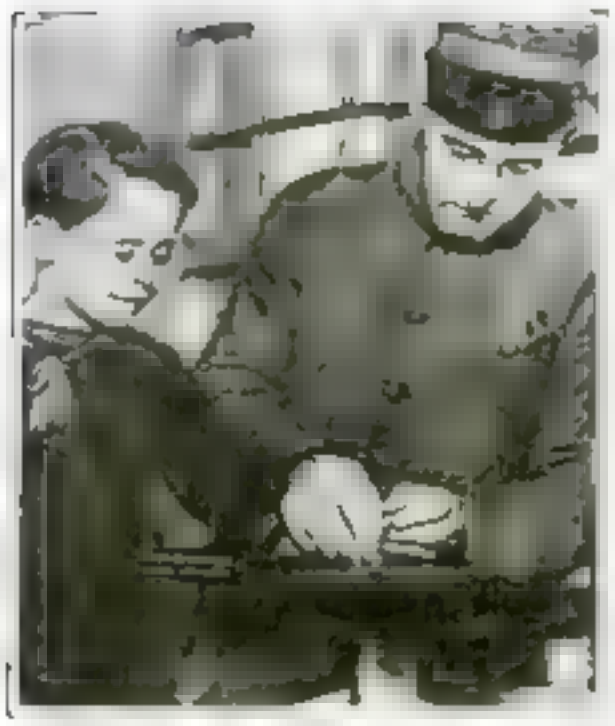
Old inner tubes are one of the most versatile of cast-off automobile parts.

"Hold-Ups" in London in Aid of a Hospital

NOT long ago the medical students of one of the hospitals organised to make a raid on London to collect funds for their hospital. To do this, they dressed in their white "overalls," much as they appear in the operating- or dissecting-room, armed with all their appliances of surgery and medicine.

In this grotesque garb they halted people on the public thoroughfares and "tested" their hearts with a stethoscope, finding out whether each person had a good or a bad heart. If the heart was sufficiently good to further the cause, the money was cheerfully given.

If the enterprising students of all the hospitals in London undertook the task of holding-up pedestrians, a good opportunity would be afforded to find out how many "good hearts" there really are in a city.



Cecil Is Fingerprinted

YOUR grandfather probably remembers the excitement that was created when Charlie Ross was kidnapped. Charlie was never found by the police, and he may be dead by this time. Hardly a month passes but the newspapers print an account of some child that has been either lost or abducted.

An anxious mother has decided that there shall be no Charlie Ross case in her family. She took Cecil to police headquarters and had his fingerprints taken.

Cecil was also measured according to the Bertillon system, but the measurements will change so rapidly, as he grows, that they will be of little value for identifying him. The fingerprints are good for life.

Fishing on Horseback

THE shrimps that live in the waters of the North Sea not far from Ostend, are the choicest in the world. They are eagerly sought by the restaurant-keepers of London and Paris. Yet the fishermen who gather them use the same methods that were in vogue in the days of the Roman occupation.

As the tide comes in, the beach is dragged for miles by fishermen mounted on horses. They pull behind them huge nets that are fastened to triangular metal frames. Poles attached to the frames help support the nets. Ropes connect the frames with the horses' saddles. Thus, as the horses move slowly through the water, they drag the nets behind them.

Whisky Hidden in Dish-Water

WHISKY is dumped into dish-water whenever a revenue officer enters certain saloons

The whisky is kept in a box beneath the bar. The lower rear edge of the box is hinged to the front of the bar, the only other support it has is a latch that can be opened by merely pulling a string. Beneath the box is the wash-tub into which used glasses are dipped. The "liquor" in the box is kept in ordinary glasses.

As soon as the revenue officer is spotted, the bartender pulls the string, releasing the latch. The box tips forward, and the filled glasses fall into the soapsuds.

We don't publish this as an aid to liquor-dealers who violate the law (they need no education), but simply to throw light on the question, "Where did he get it?"

"Meet Me at the Notions"

"MEET me at the notions, Mary" Mrs. Brown sees her name and this announcement in the department-store "engagement book," and she immediately seeks out the notions. Other women do the same thing, and in this way the entrance to the store is not blocked; but another instance of the adage that there are several ways of killing the well-known cat.

The manager of the store placed this engagement book on the radiator near the entrance

When two customers arrange to meet each other at the store, the one arriving first writes a note to the second, and continues on her way

How Motor-Trucks Benefit a Nation

AMERICANS seldom stop to think what the motor-truck means to the business of the country

In the Argentine grain is hauled in horse-drawn carts at a rate varying from $.40 a ton for three miles to $3.40 for fifteen miles. A farmer who lives twenty-five miles from the station pays as much to get his produce to the railroad as to transport it from Buenos Aires to New York.

In the United States the cost of doing the same work with motor-trucks averages fifteen cents a ton mile.

Do You Know What Quicksand Is?

OCCASIONALLY a spot on the sandy beach or on the course of a stream can be found where a man or a horse would be swallowed up. It is a quicksand.

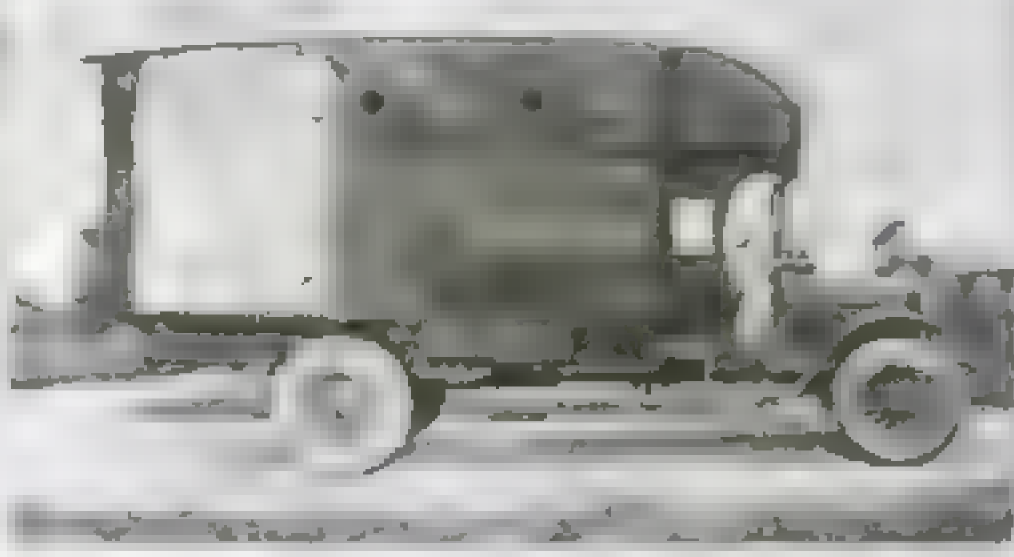
Any sand can become quicksand if there is an upward inflow of water, and if the amount of water is sufficient to more than fill the spaces between the grains of the sand. In construction work, where the movement of surface water is often interfered with, quicksands may be formed.

The remedy is foundation work to restore ground water to normal level.

Before you [illegible] a front [illegible] you will have to remove the old paint. You will save time by using a little [illegible] [illegible]

New Accessories for the Owner of Motor-Truck or Automobile

[illegible]

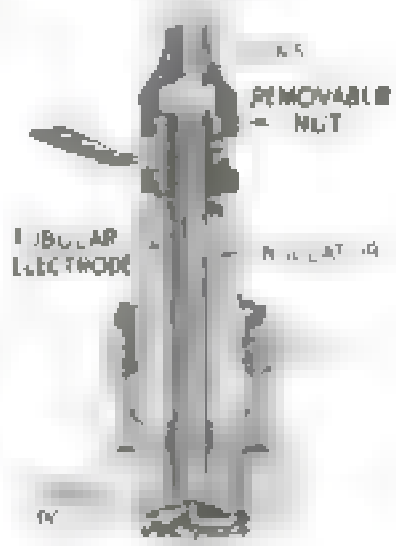


Motorized circus companies and military bodies on long marches are now equipped with bathrooms on wheels. The body has the appearance of a moving van and is divided by a partition into a dressing room with lockers and the bathroom, which has eight showers with hot and cold water

Owners of Fords will appreciate the new license-plate holder shown here that does not interfere with the crank or the shock-absorbers

Skidding is one of the dangers of automobiling and its prevention an ever-present problem. Here the suction principle is used to prevent skidding

A device for foiling the automobile thief consists of a steel cable inserted in the [illegible] bumper. Before [illegible] the car, its [illegible] wraps the cable [illegible] front wheel, and [illegible]. Any attempt to start the car starts a bell [illegible]



This spark-plug has a [illegible] through which you can watch the spark [illegible] whether your gas mixture is right

Regulation of the openings in this radiator-cover, to suit variations in temperature, is secured by the radial, triangular slots that may be closed by the pinwheel-shutter

To show the ease with which this rim is operated the makers employ a one-armed man to remove a rim and put another in its place

One of the new automobile models has a pocket for small tools in the side door and a large sliding drawer under the front seat for the larger tire-tools

Do You Want Advice About Your Car?

DOUBTLESS you have received many a hint about the care of your automobile or motor-truck from the pages of the Popular Science Monthly. We realize, however, that special cases require special advice. We therefore invite you to send your problems to the Automobile Editor. If you wish to know more about the devices pictured on these pages, or if you would like special automobile advice of any sort, ask questions. You will find some inquiries unswered on page 82.

Fool-proof and of practical design is a new electric heater that can be operated by wiring it to any electric-lamp socket. It may be used for keeping the engine and radiator warm in cold weather

As a protection from dust and wind autocr obilists in Paris wear leather hats like this. These hats or hoods are ventilated and provided with inset frames into which white or colored transparent celluloid windows are fitted

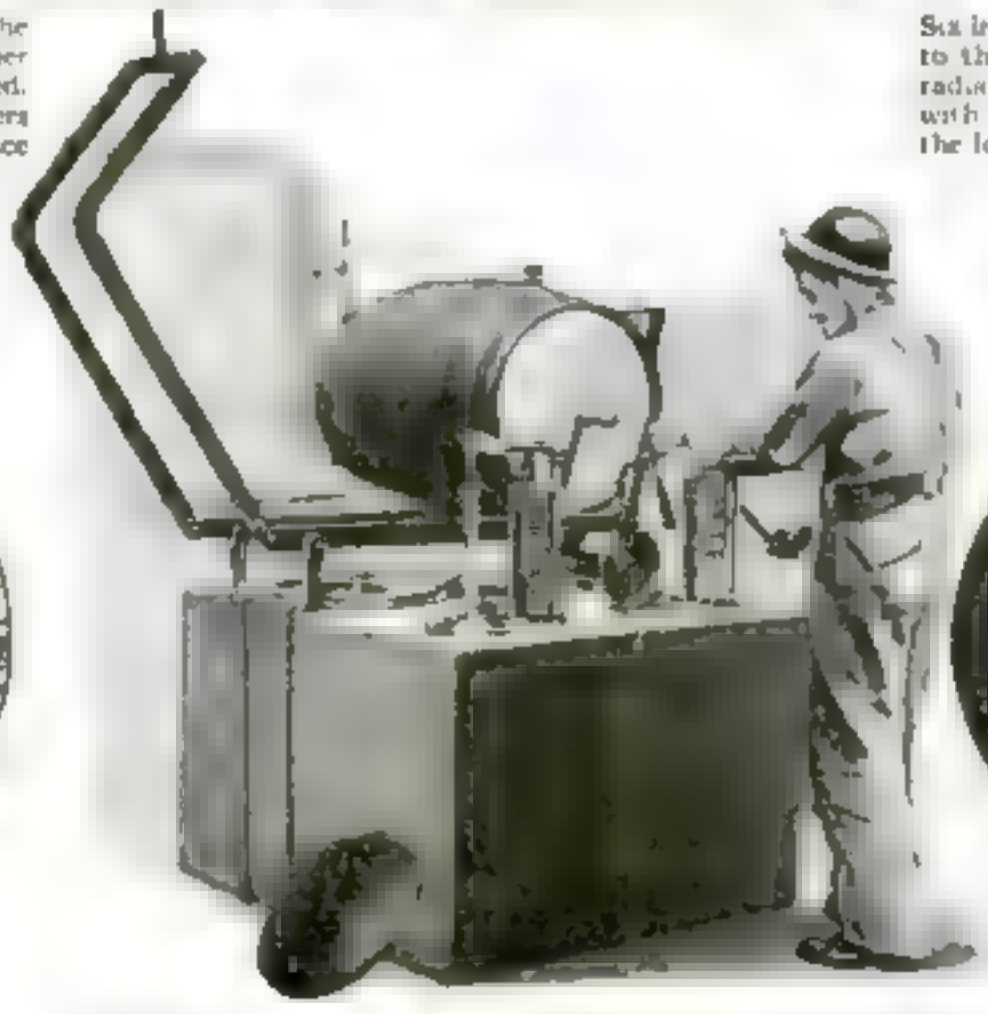
Another thief foiling automobile lock which, when locked, prevents the use of the steering-wheel. It is made in thirty sizes to fit different makes

Notches in the rim of the steering wheel enable this automobile clamp to drive. The hooks at the ends of the arc-like arm can be engaged in the notches

How the adhesion between the tread stock and the inner rubber base of truck tires is determined. The force for separating layers is measured with a spring balance

Six inches of wire chain soldered to the inside of the cap of the radiator-filler pipe and provided with a wire anchor will prevent the loss of the cap

The hydraulic shock-absorber here illustrated is inconspicuous and can be installed on any car without requiring alterations. It has no springs nor straps



Waste and untidiness can be avoided where much lubricating oil is handled, by installing this storage-tank with hoist pumps

This clamp for radiator hoses requires no screws. Its lever engages a notch, of which there are four, to allow for tubes of various sizes

Spraying Fruit-Trees by Motor-Truck

It carries the apparatus and furnishes power for the pump

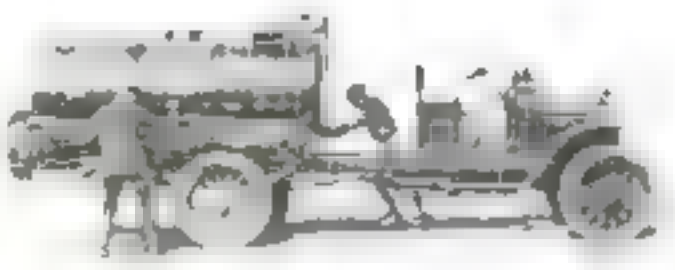
IN spraying trees on a fruit-farm the motor-truck is filling a very useful position. Not only does it provide the means for moving the apparatus from place to place, but it also furnishes the power for the pump that sprays the liquid.

The tank, pump, and spraying nozzles are demountable from the truck chassis. When the spraying work is done, the entire apparatus may be removed and an ordinary truck body fitted, so that the vehicle may be used for hauling.

Because of the large horsepower of the truck engine that is used to operate the spraying pump, the equipment is one of the fastest working sprayers ever offered to fruit-growers. With one man driving the truck and two others holding the nozzles, small trees may be sprayed at the rate of one hundred and fifty an hour.

The tank in which the liquid is carried has a capacity of six hundred gallons. The pump, which is driven by a power take-off attached to the truck transmission, is of the rotary type and will pump thirty gallons a minute against a pressure of three hundred pounds. The excess capacity of the pump not used by the nozzles is pumped back into the tank through jets located along its bottom, thereby providing for the agitation of the spraying liquid. The spray pump may be operated either while the truck is in motion or is standing still.

All four truck wheels are provided with flanges to prevent the wheels from sinking in the soft ground as it moves in and out between the rows of trees. On account of the high pressure of three hundred pounds that can be maintained by the pump, the spray thrown by the nozzles is exceptionally fine. This means, of course, economy in the consumption of the spraying-liquid, which is an important item both as to the amount of solution used and the time consumed.



The entire outfit may be demounted from the truck and an ordinary truck body fitted on instead

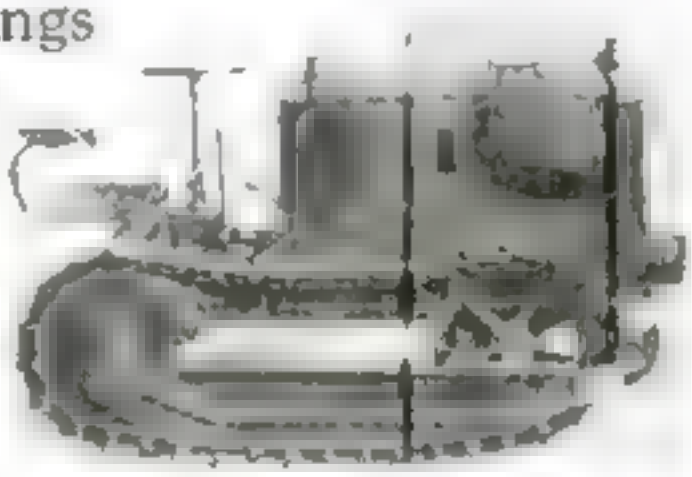
The tree-spraying tractor moves easily from place to place. It furnishes power for the spraying apparatus

Fresh Air for the Farm Tractor's Lungs

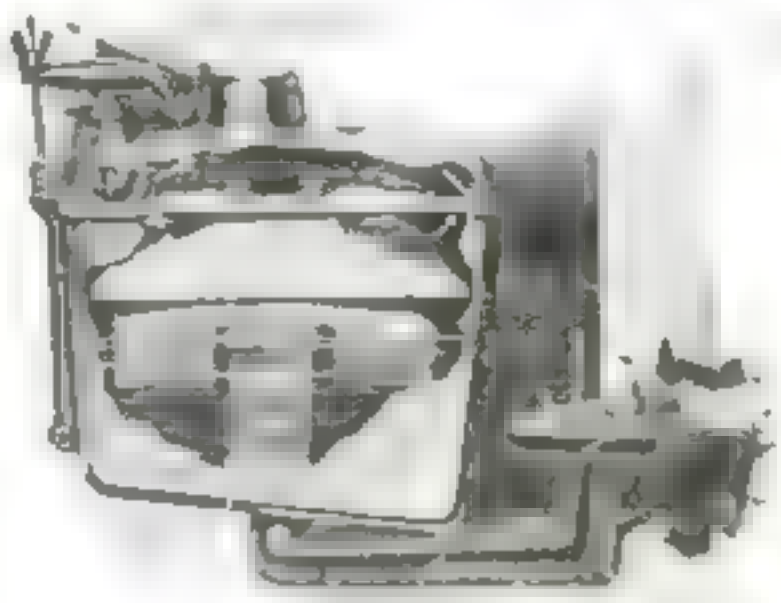
ONE of the greatest causes of excessive wear in the engine of the gasoline farm tractor is the fine dust drawn into the engine cylinders in the air vaporized with the fuel in the carburetor. Except in wet weather, the tractor is almost continuously enveloped in a haze of dust-laden air, and yet it is from this air that the carburetor has to draw for making its explosive mixture. This evil always will be present in power farming, where the tractors are run at a fair rate of speed. Dirt, when once in the cylinders, tends to score the cylinder walls, gum up the lubricating oil, and results in excessive wear of all the moving parts.

There have been many attempts to fit some sort of air cleaner on the tractor to remove this dust from the air before it reaches the carburetor and is mixed with the fuel. Some designers have employed centrifugal cleaners and others a water cleaner in which the air is expelled below the surface of the water and forced to pass through it before being led to the carburetor. Neither one of these devices, when used separately, has proved satisfactory. So it has remained for one of the large creeper-type-tractor manufacturers to devise a combination system in which both the centrifugal dry-air cleaner and the water cleaner are employed. How this system is worked out is shown in the accompanying illustrations.

The air drawn in through the radiator by the fan is first forced past and through the dry-air cleaner of the centrifugal type. This cleaner takes about ninety per cent of the dirt out of the air. This partially cleaned air then goes up through the intake pipe of the water cleaner (mounted outside of the engine hood, as shown in the illustration) and down below the surface of the water. It then rises against the series of two baffle-plates that tend to separate the particles of water from the cleaned air so that the entirely clean air fed to the carburetor is moist and yet not fully saturated



The air to be used in the carburetor is sucked in through the radiator



Air is forced through a centrifugal cleaner and a washing tank filled with water, where nearly all dust is removed

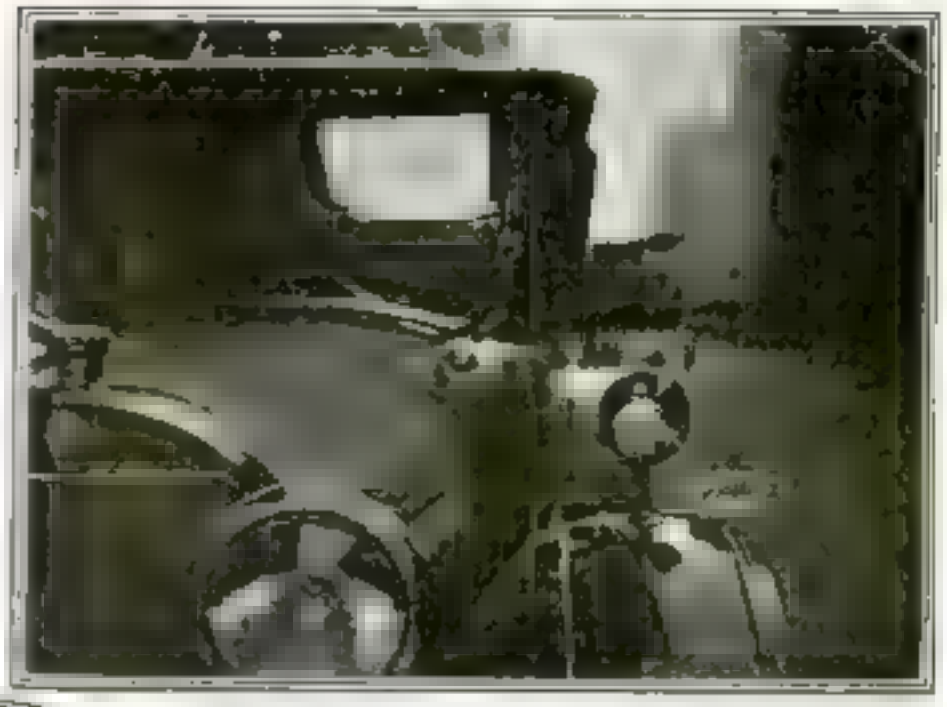
Whistling for Water

A sort of mechanical Tommy Tucker, which, instead of singing for supper, whistles for water or oil when the engine gets hot

TO warn the motorist of an overheated engine, a New York manufacturer has invented a device that is heard and not seen. The new apparatus works only when the water runs low in the radiator, and that remaining is turned into steam. Then a whistle is sounded—a siren that can be heard above all the din of the city streets.

The indicator consists of a cylindrical barrel above the top of the filler-cap, together with a tube that extends from the interior of the barrel down into the top radiator-tank. This tube is cut like a whistle, and when the water in the radiator is turned into steam, the steam issuing through the cut in the tube gives a whistle.

The device serves also as a water-gage.



Mounted on a short arm on the left front fender, this apparatus combines a white light, a red one and a mirror

A Mirror by Day and a Light by Night

BECAUSE every state requires that a red light be shown at night on the back of vehicles and a white light in the front and many states require that a mirror be mounted within sight of the driver so that he may observe cars approaching from the rear, a New York concern has brought out an accessory that combines all three functions.

The apparatus, mounted on the left front fender, is made up of a cylindrical casing with a white lens in front and a red lens in back. Inside the casing is an electric bulb, which is wired up to the storage-battery. The casing is supported on a short vertical arm, to the rear of which is also pivoted a circular mirror.

Tractors in the Army

IT is the intention of the United States government to substitute tractors for horses in every branch of the army where it is at all possible. This means, probably, that the near future will see the complete absence of horses, with the exception of the cavalry.

The tractor shown in the picture below is one of a series of machines that the Ordnance Department is developing toward that end. It weighs three tons and would take the place of six horses. Its speed is about that of a galloping horse.

An interesting feature is the creeper mechanism, which is designed to follow the contour of the roughest ground. In addition to the big wheels, there are four rollers in contact with the lower side of each creeper. They are mounted on cantilever springs and hold the belt in contact with the ground. They are linked also to the rollers, which press against the upper side of the belt.

This sign, placed conspicuously on an automobile in the driver's absence, acts as a watch-dog. It would be difficult for a thief to cover the word unobserved

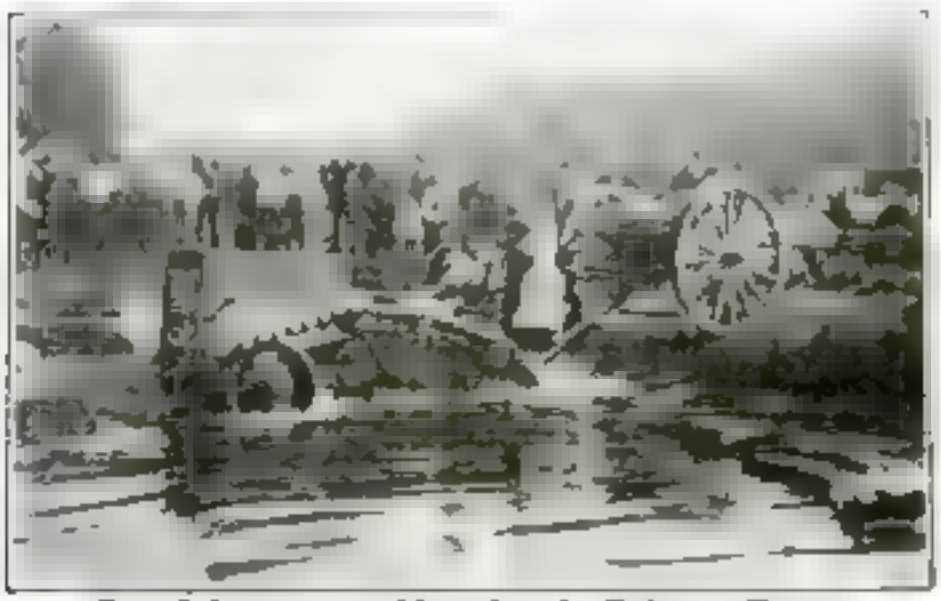
"Watched"—to Make the Automobile Thief-Proof

OF the very great number of "Stop thief" devices that have appeared in the automobile market in recent months—and, owing to the increasingly frequent robberies, many inventors have been devoting much time to the problem—nearly all depend on rendering inoperative some part of the mechanism. An automobile-thief trap recently invented by a New-Yorker, however, does not work on this principle. Instead, the owner or driver, when he leaves his car, simply pulls out a corrugated plate, thereby exposing the word WATCHED.

Since the device is attached to the windshield or some other conspicuous part of the car, the theory is that a thief will pass by a car with this label in full view of every passer-by.

The plate and its container are interlocking, and there are no duplicate combinations, hence only the owner's plate will blot out the telltale word. It would be difficult for a thief to find a quick substitute covering or to paste anything over the word, and, even if he did, detection would be sure to follow.

This invention is clearly based on a knowledge of psychology. Even a hardened automobile thief would have the sensation of a stern eye upon him as long as the card was in evidence.



One of the many machines that the Ordnance Department is experimenting with, the object being to substitute tractors for horses in the army

Helping the Motor-Truck Driver

Consider him if you would get the most out of your equipment

By Joseph Brinker

GOOD drivers do not simply "grow." They are made.

Assuming that the driver knows the mechanics of his business as to how to stop and start, change gears, lubricate engine and chassis, and load his truck body, there are many other things that the owner can do to help him get the most out of his truck.

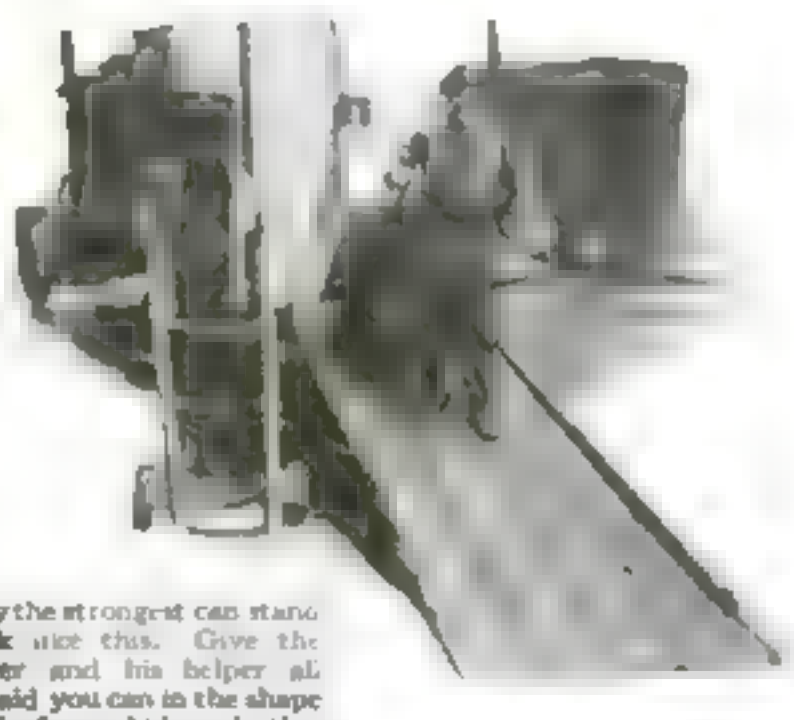
Many of the things that the truck-owner can do to make his motorized delivery satisfactory apply with equal effectiveness to the owner of one or two small trucks as to the owner of fifty or a hundred large-capacity trucks. But an increase in the number of your truck-drivers introduces special problems of supervision.

Assuming that the driver knows his business, he ought to be provided with certain conveniences that will enable him to give the best that is in him. These conveniences are: closed cabs; heated cabs; self-starters; special body designs for ease in loading and unloading; proper skids for handling heavy loads; other loading and unloading means, such as cranes or derricks; platforms; and uniforms for drivers handling any goods that would make the wearing of a uniform at all feasible.

Protection from Storms

The closed motor-truck cab is following the development of the closed vestibule on the trolley-car, and for the same reason. The driver who is exposed to rain, sleet, and snow, who is soaked to the skin and chilled to the bone, cannot be expected to do his best work. It is against human nature. The damage does not stop with the poorer physical work done; it is transferred, in a way, to the truck itself. A driver who will not do his own work well will also not give his truck the mechanical attention it requires. The result—higher operating and maintenance costs, with a subsequent high cost of delivery per ton, package, or other unit of measure.

The use of heaters in truck cabs is another step in the right direction. Heaters can be bought. They utilize the heat of the exhaust engine gases to warm the air in the cab. A cab heater is an item of comparatively small cost, but of large influence toward making a warm, contented driver who will do good work and take good care of his truck



Only the strongest can stand work like this. Give the driver and his helper all the aid you can in the shape of platform skids and other facilities

Ask Us!

DRIVERS are the key to truck success. They can make transportation by motor-truck a success or failure. A good driver with a poor truck may show better results than a poor driver with a good truck. No machine is more efficient than the man who runs it.

Mr. Brinker points out the part that the driver plays in getting the most out of the truck.

If there are any questions that occur to you about motor-trucks, write to us. It doesn't matter whether you own one truck or fifty.—Editor.

Many types of devices for loading and unloading can be obtained Here is a small crane that makes lifting easy

Save His Strength

Self-starters make it possible for the driver to do more work with less exertion. The increased use of starters has been most noticeable on the smaller sizes of trucks that are mounted on pneumatic tires. On such trucks the cushioning effect of the tires tends to prevent the truck vibration from damaging the electrical equipment and battery

Self-starters save fuel. The driver will not shut off his engine during short stops if he has to crank it by hand While the gasoline saved may be small at each stop, it amounts to a considerable amount in a day, a month, or a year. The larger the number of trucks in service with starters, the larger will be the fuel savings in the aggregate.

Consult the Driver

The body type is generally adopted without consulting the driver. He ought to be asked what kind of body will enable him to do his work quickly and well. Too often he has to make the best of a standard type of body when some small change, either in the location of the doors or the introduction of some kind of shelving, will greatly help the driver in loading and unloading.

No fixed rule can be given as to body types. A type of body eminently suited for one class of work may be entirely unsatisfac-

tory for another. Make a thorough study of the particular conditions under which the truck must work, and then select a body that most nearly meets all of the peculiarities of those conditions.

Skids Save Lifting

Skids are another simple truck accessory that often help to speed up the work of the driver and make easier his physical tasks. A driver who is not fagged out will generally pay closer attention to the actual driving of his truck, and have fewer accidents and collisions. When especially heavy loads, such as barrels, have to be carried, every attempt to avoid physical lifting on the part of the driver should be made. One way is to mount a small derrick or crane at the side of the truck body at the rear. With such a device barrels may be loaded or unloaded with a minimum of effort. Such a crane is, of course, of the greatest value for unloading on to the sidewalk at the points of delivery where it is not possible to set up a platform upon which the barrels may be rolled off with no lifting at all.

At plants or warehouses all loading and unloading platforms should be made as nearly as possible level with the floors of the motor-truck bodies, so that the goods may be rolled instead of lifted into and out of the bodies. While little if any attempt has been made at standardizing truck-body platform heights, a platform forty-two inches off the ground will be level with most truck bodies now in use.

Uniforms also play a big part in the respect that a man has for himself, for his truck, and for the firm for which he works. While the uniform is today used principally by drivers of department-store trucks, florists, and jewelers, the psychological effect should be considered in uniforming the coal-truck driver, the contractor's truck-driver, and others, with a uniform, even if it is a pair of overalls and jumper in summer and a heavy coarse pea-jacket in winter. Colonel Waring heightened the self-respect of New York street-cleaners by dressing them in snow-white duck. Street-cleaning ceased to be a dirty calling. A uniform makes even the driver of a coal-truck think more of his personal appearance. One large Pittsburgh coal-dealer has gone so far as to equip his garage with

This truck is fitted with shelves on which packages for retail tobacconists are stowed. Properly marked, it is easy for the deliveryman to pick out each dealer's package

Have you closed cabs on your trucks? When a driver is half cold he cannot drive carefully or attend properly to his truck

a battery of shower baths, simply that his men may ride home clean at night and not be ashamed to ride in a trolley-car with office workers. The coal-dealer who introduced this plan considers it one of the most important advancements he has made; his results have more than offset the cost by reason of the greater contentedness among his men.

The Driver the Key to Success

All this, with the possible exception of the shower-bath idea, applies just as well to the man who operates only one truck as to the man who operates a hundred. These are fundamental principles. Human nature is fairly constant. The truck-owner should always bear in mind that the driver has in his own hands an expensive piece of mechanism, which, if treated properly and adequately equipped, will reduce transportation costs. Most of the day the truck is out of sight of the owner or superintendent. The driver, in the last analysis, is the real key to truck success or failure.

As the size of the driver organization increases, the problems change, principally because of the loss of the personal contact between them and their superior and the increased difficulty of getting them all together at any one time for instruction or inspiration. When the driver organization is large, there is an opportunity for introducing the competitive spirit among them as expressed by some form of bonus for good work, freedom from serious accidents and customers' complaints, tonnage carried, fuel economy, or other factors.

No one fixed bonus system can be applied to all trades. Bonuses may be offered for almost anything that means better trucking. The kind of work performed and the trouble experienced with the drivers all have their influence upon deciding for what

In factories that furnish lunches for their employees, the motor-truck drivers ought to be made welcome. Exposure to all kinds of weather makes hot food especially appreciated

the bonus is given. But, no matter for what the bonus is given, it will fail unless every driver in the crew has an equal chance to win the prize. Unless each driver gets a "square deal," any bonus system is a failure.

One method of making good drivers in a large fleet, after a concern has decided just what its drivers should and should not do, is to talk to them occasionally in large or small groups.

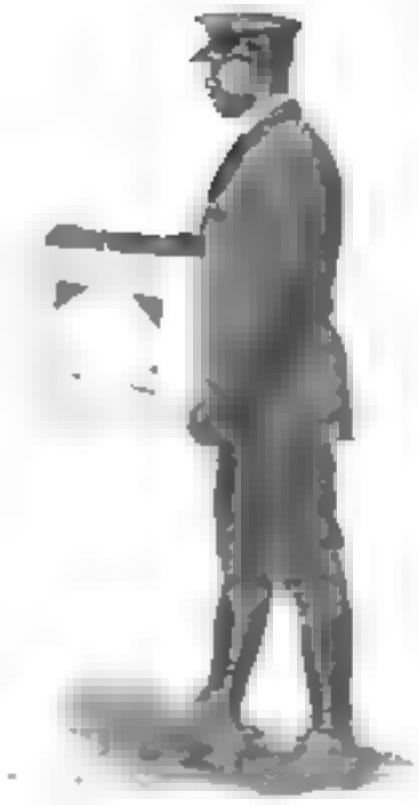
There are two ways of talking to large groups of drivers, one by word of mouth, and the other by the printed word. For personal talks, the drivers should be assembled on company time and told what the company is attempting to accomplish and how they should act and not act under certain conditions. This is perhaps the best method of driving home ideas on how best to operate and maintain a truck so that its life shall be long and useful.

A small printed pamphlet is a material help if the force of drivers is a large one and can not be conveniently called together in a group because of operating conditions. These pamphlets may be in the form of bulletins arranged to fit in a binder to be carried by the driver at all times. The concern's house organ or magazine may also serve to stimulate the truck-drivers and make them feel that they are an integral part of the firm's organization and that they can do just as much to build success as the salesmen or the office workers.

Don't Bar the Driver from the Lunch-Room

Where a large fleet of trucks is maintained in a private service station, and lunch-room facilities are offered for the mechanics, the same facilities should be extended to the drivers who return before noon for afternoon deliveries. Truck-drivers appreciate hot lunches just as much as factory workers. Make them feel that they are essential parts of the organization, and they give better service.

It should always be borne in mind that the driver is a human being; that he is entrusted with an expensive piece of machinery that praise given when due, results in greater loyalty and better service rendered



Put the delivery truck-driver in uniform. It will give him greater respect for himself, for his truck, and for his firm

Write to Us About Your Motor Troubles

If you have a motor-truck or automobile problem, let the Automobile Editor solve it

Why Kerosene Develops Knocks

Q.—Will you please explain why the ordinary gasoline engine develops a serious knock when kerosene is used as fuel instead of gasoline? -L. A. P., Hartford, Conn

A. A mixture of kerosene and air has a lower ignition temperature than a mixture of gasoline and air, and unless the compression pressure inside of the engine cylinders is reduced the kerosene fuel pre-ignites, causing the engine knock to which you refer.

Rates for Overland Hauls

Q.—Using a 5-ton truck, how much should I charge a mile for a full load for overland haulage work on trips 100 miles long in each direction? -J. H., New York City

A.—The average rate for such work with 5-ton trucks has been $1 a mile, or $100 for a trip 100 miles long. It does not cost $100 to run a 5-ton truck for this distance, but the rate a mile must include items for the cost of doing business and a profit for the truck operator, in order that he may continue in business. When such long trips are made, it is usual for the truck owner to endeavor to obtain in advance a return load from the city to which the first load is delivered.

If the Engine Knocks

Q. I operate a 5 1/2-ton truck whose engine begins to knock on every cylinder when subjected to the slightest strain. I have examined the bearings, the valve timing, the magneto, the spark plugs, and cleaned out the carbon and yet have not been able to eliminate the knock. Could you advise me what to do? -H. H., New York City

A.—One of the causes of the trouble may be a too high compression pressure in the cylinders. If the engine has a detachable head, the compression pressure may be reduced slightly by inserting a 1/64-in. or a 1/32-in. gasket between the tops of the cylinders and the bottom of the cylinder head. This will increase the combustion space in each cylinder. This, in turn, will reduce the compression pressure and may eliminate your trouble.

How to Figure Grades of Hills

Q.—To settle a controversy will you please tell me what angle corresponds to a grade of 100 per cent?—T. D. P., New York City

A.—A grade of 100 per cent corresponds to an angle of 45 degrees. The percentage of the grade is the ratio of the vertical rise in feet to the horizontal distance traversed in feet. Thus, a vertical rise of 100 feet in a horizontal distance of 100 feet gives a grade of 100 per cent with the angle of the grade 45 degrees.

When Pistons Are Worn

Q. How can I tell whether new pistons and rings are necessary for an engine which has low compression. J. K., Chicago

A. If a thorough examination of the valves shows them to be in good condition and seating properly, an excessive wear of the pistons and rings will be indicated by an excessive amount of oil on the spark-plugs. Another method employed to detect worn piston-rings is to place one's ear close to the breather pipe of the engine while it is being turned over by some one else. If the pistons and rings are very loose, the air getting by the pistons can be heard distinctly when each piston is on its compression stroke.

Judging Engine Vibration

Q. Sometimes I think the oil gage on my engine does not register accurately. Will you please tell me by what other methods I can determine if there is too much oil in the engine. H. K., St. Louis, Mo.

A.—An overlubrication of the engine will result in rapid carbon deposits. These, in turn, will result in overheating and a loss of power on hills. Too much lubricating oil is indicated when the exhaust gas is bluish white in color. A light smoke of little density is not necessarily a sign of too much lubrication.

Prevent Frozen Radiators

Q. Is it considered a good practice to use kerosene in the radiator water to prevent freezing? F. O., Newark, N. J.

A.—Kerosene is not recommended as an anti-freezing compound principally because of its harmful action on the rubber hose connections. Alcohol or glycerine or any other patented anti-freezing mixtures can be bought at almost any garage and are preferable to kerosene.

Gas-Engine Temperatures

Q. In the average automobile gasoline engine what is the temperature and the pressure a square inch inside the cylinder at the time of the explosion? —A. B., Philadelphia, Pa.

A.—The temperature at the moment of explosion varies with the design of the engine, but is generally between 1200 and 1800 degrees F. The pressure also varies according to the engine design. With an engine compression of 75 to 80 lbs. a square inch, the pressure at the time of explosion would be between 300 and 400 lbs. a square inch.

Save Repair Bills

By **James G. Hilton**

THE excessive charges for small and simple repairs that are usually made by automobile service-stations, as well as automobile repair shops, have done more than anything else to stimulate the average owner of an automobile to learn the construction of his car and undertake to do the less difficult repairing himself, according to an enthusiast who has been able thus to reduce the expense of keeping an automobile. Especially in the suburban communities it is a common thing to see owners repairing their automobiles which formerly they were accustomed to take to the repair-shop.

"The first year I had an automobile," said a suburban automobile owner, "I had an idea that the only place where it could be properly repaired was at a service station. The first time I took my automobile there was to have the carbon removed and valves ground.

"When I enumerated the things that I wanted done, and asked for an estimate of the cost, which I knew was usually about $8 for a four-cylinder automobile at most garages, I was told that it was not possible to set any definite figure. In addition, it might be possible that some of the valve-stems were bent, and these would make for additional cost.

"However, when I insisted that I did not want to have the repairs made without knowing more definitely what the job would cost, I was informed that the charges would be something like $9 or $10. With that understanding the automobile was left for carbon removal and valve-grinding, and the resultant expense was $9.95, including a new gasket at 95 cents.

"The next time I desired to have the carbon removed, I went back to the service station, but failed to take the precaution of getting an estimate on the work, thinking it would be about the same. When the bill was presented, it amounted to $18, and the largest item in it was for labor at $1 an hour.

"This experience showed me the necessity for undertaking the work myself, and the next time that it became necessary to remove the carbon and grind the valves I got a few pointers from one of the skilled mechanics at the garage where I kept the car. I was a little slow with the first undertaking, but I was able to take the automobile entirely apart, then clean it, and assemble the parts again within six hours, and I was also able to use the old gasket, which was still in good condition after the second time the carbon was removed.

"In all my experience in removing carbon, I have yet to find a valve-stem that needed replacement, and I have run my car nearly 10,000 miles. I figure that, even granting that the service station pays its mechanics $1 an hour, an $8 charge for the job is a fair one.

"On another occasion I had taken my automobile to a service station to have a repair made so as to stop grease and oil leaking into the brake-drum. When I got the itemized bill, it included charges not alone for this specified repair, but charges for new felt washers, readjustment of foot and emergency brakes, and other things I had not ordered. Apparently an inexperienced workman had done the job, and before I drove the automobile home, a distance of fifteen miles, the grease was leaking into the drum again, and I had to take the automobile back to the service station several times before the defect was remedied. The trouble was found to have been caused by putting too much lubricant into the differential housing.

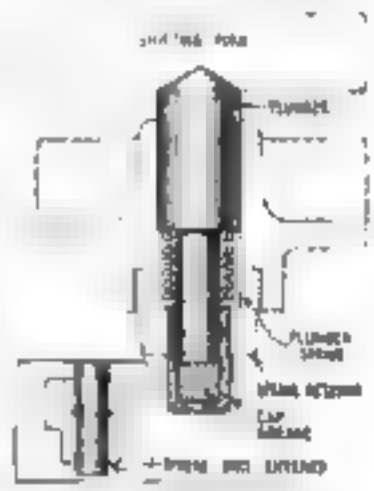
"Encouraged by success in making those first repairs, I finally got up the courage to explore other parts of the automobile, and I not only found that I could keep the different mechanisms in good running order, but I believe I take somewhat more care in doing these jobs than the average green mechanic who had done previous repair work on the same automobile. In addition, I have always found a great deal of pleasure in learning all about the construction of the automobile, and the knowledge so acquired has stood me in good stead."

Study your automobile and save money by doing minor repairs

The owner estimated that the repairs on his car during the first year cost him from $75 to $100. During the present year his total repair bill has been under $1, and this included 15 cents for a foot-brake cam support which he replaced when the part was snapped by an obstacle bouncing up from the road-bed, and a terminal for the storage battery.

Protecting a Gear-Box Fork Plunger

WE recently had occasion to determine the cause of a faulty gear box on one of the automobiles in our garage, and an examination revealed the fact that dirt and dust had entered at the point where the forks that hold the shifters in position, were placed. This caused the locking plungers to bind, with the result that the shifting of change gears became a source of constant annoyance.



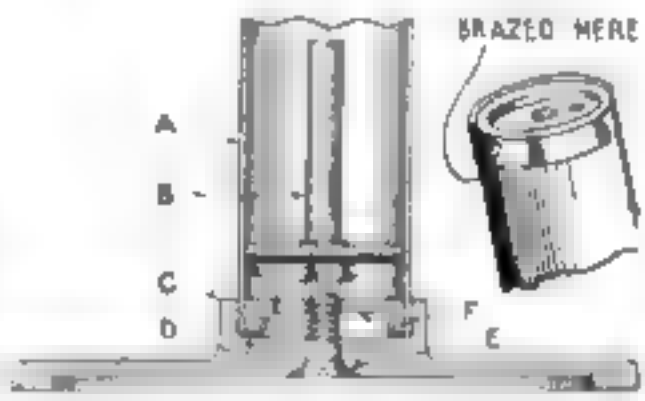
The cylindrical cap protects the locking plunger from dirt and acts as "grease" cup

The repair consisted of reboring and tapping the spring retainer, and placing therein a closed cylindrical cap, of such length as to enable the plunger to easily operate the desired amount. Incidentally, the cap served as a grease cup. ADOLPH KLEIN.

Repairing a Worn-Out Hand Tire Pump

THE writer recently had occasion to use his hand tire pump and found the threads stripped where they are threaded into the base. Not being able to find a repair part, he proceeded to fix it up himself.

In the accompanying illustration *A* shows the cylinder made of steel tubing, *B* the piston-rod assembly, *C* a section of the cast-iron base, all of which are component parts of the pump.



The tire pump with worn-out thread was fastened to its base with a machine screw

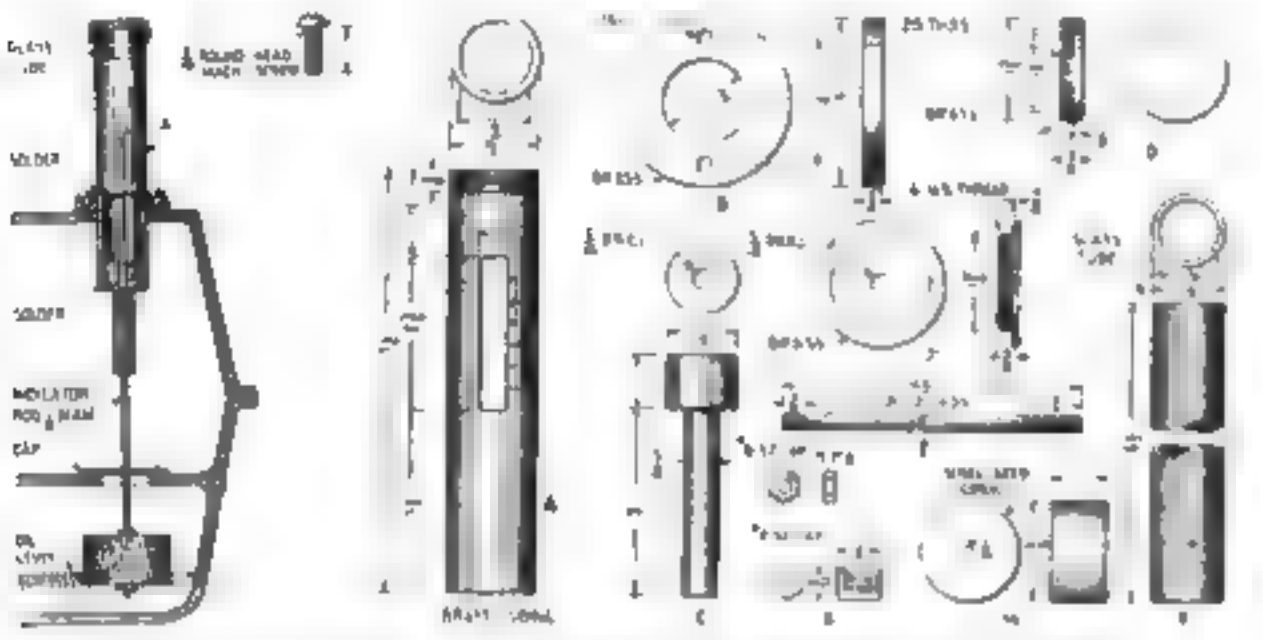
A piece (*F*) was turned up on a small lathe out of machine steel and brazed into the end of the cylinder. This piece had a 3/8-in. tapped hole in the center and a 3/16-in. air vent-hole at one side of the center. This air vent-hole is used to get the air down to the port that leads to the hose.

After brazing into the tube, the cylinder was pulled down into the base by the screw *E* and the whole seated on the leather gasket *D*.

How to Construct an Oil-Level Indicator

By Adolph Klein

THE drawings herewith illustrate the details of an oil-level indicator that was built from odd scraps of material taken from the garage junk-pile. The gage was built by the owner of an old type of automobile, who was invariably annoyed by the fact that he could never tell how much oil was in the engine crankcase of his car. He finaly determined to construct for himself some form of gage that would readily inform him of the amount of lubricating oil that his crankcase contained. This same type of gage could be employed in connection with the various forms of liquid-carrying tanks used around the garage.



From odds and ends found in almost every garage a thoroughly efficient oil level gage and indicator like that shown here may be made

The body of the gage was made from a discarded starting-crank handle, made of brass, of the dimensions indicated in the diagram. The tube had a rectangular slot cut along the length of its axis, upon which a graduating scale was scratched. The manner in which this graduating scale was made is as follows: To the body was fastened a flange and the plunger guide. The flange, circular in shape, was made from an old thrust-ball bearing, and was soldered permanently to the tube. In addition, it will be noticed that this disk was provided with two 3-16-in. holes for permitting two machine screws to pass through it and into the crankcase wall. The plunger guide was turned from a scrap piece of bar brass, and was soldered to the lower portion of the gage body. A cap covers the top of the body and prevents the dirt and grit entering the inside of the gage. To further prevent this, a glass tube is inserted inside the brass tube. This glass tube is made of such diameter and length that it is held securely in position when the cap is screwed into position. The plunger-rod is threaded at the top for a knob and at the bottom for a cork float. A hexagonal nut, placed on top of the float, and another, placed at the bottom, hold it at all times firmly.

Another flange is screwed into the lower crankcase and guides the lower portion of the rod. It is well to remember that the cork float should at all times be thoroughly shellacked.

The measurement scale on the gage body is determined in the following manner: The entire gage is assembled, and screwed into position by means of the two machine screws, after which all the oil is drained from the lower crankcase. In this position, the knob at the top of the plunger rod should come approximately $\frac{1}{2}$ in. above the lower line of the slot in the gage body. In this position, a small horizontal line is scratched on the tube directly beside the knob. This line is marked *O*, indicating that in this position, there isn't any oil in the crankcase. The case is then filled at intervals with quart amounts of oil and the position of the knob is indicated with the proper figure, corresponding to the amount of oil that has been poured into it.

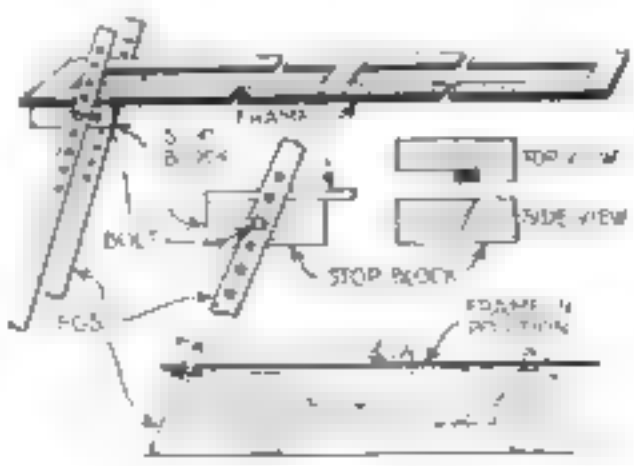
Protecting Freshly Varnished Mudguards from Dust

PAINTING and varnishing the body of an automobile requires scrupulous cleanliness and great care to prevent the dust, which is nearly always found suspended in the air, from settling on the freshly painted surfaces.

When automobile bodies, the sides of which do not project, are varnished, the engine cover is usually removed to be varnished separately indoors. The mudguards, however, remain in place, and are exposed to the danger of being marred by dust dropping on the varnish before it has had time to dry.

An adjustable device to protect the mudguards from dust after they have been painted and varnished is shown in the accompanying illustration. The light wooden frame, similar in form to the frame of a door-screen, but much narrower, is fitted at one end with a pair of adjustable legs fastened by bolts to a block on the frame and kept at a certain angle by a stop block.

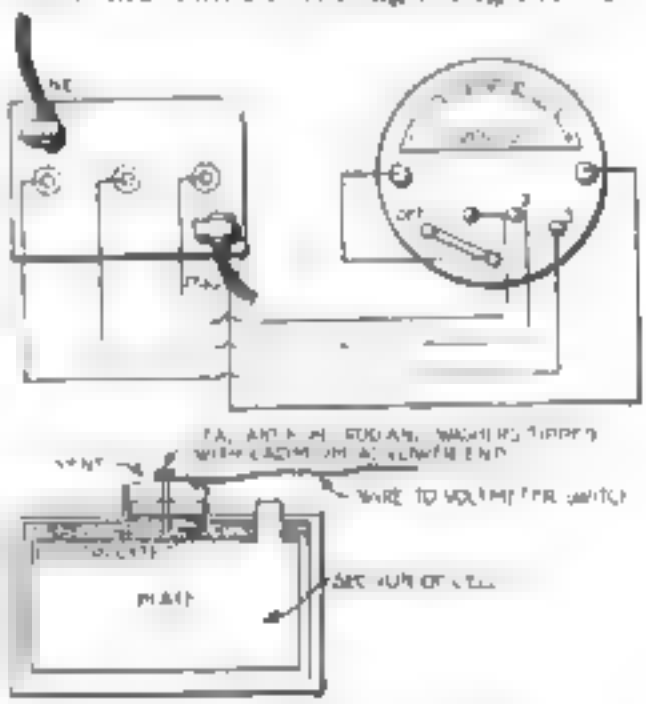
The frame itself is covered with heavy paper. There should be a frame for each side of the car. Two legs only and both of them at the same end are required for each frame. The other end of the framework is supported by a stick or board laid across the engine. In garages where a number of automobiles are housed, such frames will be extremely useful. When they are not needed they can be folded up and stowed away in some corner for future use.—JAMES M. KANE.



After the automobile has been painted and varnished, protect it from dust while drying

An Indicating Device for Storage Batteries

STORAGE batteries are used at the present time on a majority of automobiles and trucks. Thousands of them are ruined through neglect to add distilled water to the battery at the right time.



This indicating device shows whether there is enough electrolyte in your storage battery

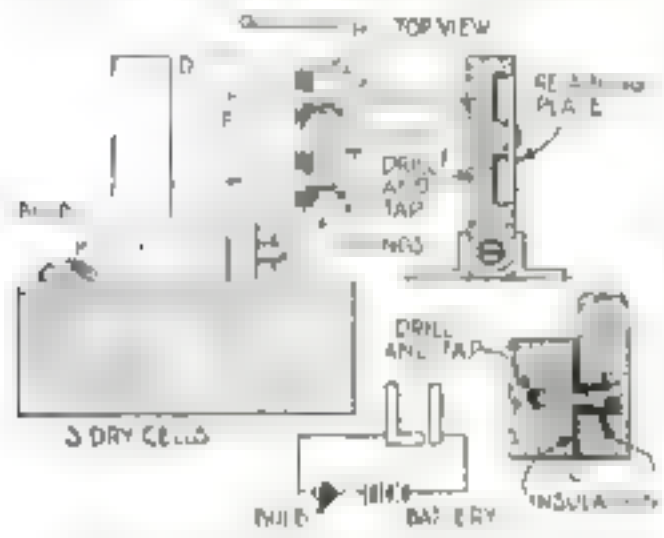
The indicating device shown in the accompanying illustration should be of interest to the automobile owner. The voltmeter and switch can be placed on the dashboard. The instrument will tell at a glance whether there is sufficient electrolyte in each cell and will also give the positive cadmium reading of the cells, showing their charging and discharging voltage on the dial.—F. S. BURROUGHS.

How to Make an Electric Contact Gage

By **Frank W. Harth**

WHERE there are large numbers of parts to be tested, the use of a feeler gage is tiresome and therefore apt to be somewhat subject to error. A fixed gage will wear very quickly unless tested every so often by a master gage and then adjusted and resealed.

Fast and accurate testing can be done with the electrical gage shown in



In this electrical contact gage the object to be tested is passed between two contacts representing the plus and minus limits

the accompanying illustration. As this gage is adjustable it can be kept accurate at all times.

The dimensions of the gage will be governed by the size and character of the work to be tested so that the design as shown in the illustration will be merely considered as suggestive.

The base and arms of the gage are made of two pieces of tool steel, one piece, *A*, being L-shaped and the other, *B*, being straight. As the measurements are determined by electrical contact, the two arms are insulated from each other at the point *C*. The drawing shows, in detail, the method of insulating and binding the two arms together. The surface *D* to *E* must be ground and finished perfectly level. The two contact arms are also made of tool steel, the surfaces *F* and *G* being ground and finished perfectly straight.

The surfaces *D*, *E*, *F*, and *G* must, of course, be hardened and lapped perfectly parallel. The lugs *H* and *J* on the contact arms are provided as stops to prevent the arms from sliding out of their grooves. Two grooves are milled in the arm *B* and a plate is fitted to retain the contact arms in the grooves. The plate is firmly held in place with a machine screw. The grooves in the arm *B* must be cut true so that when the contact arms are fitted there will be a minimum of up and down or side play.

Two holes are drilled and tapped as shown for the stops. These stops are fine thread machine bolts provided with lock-nuts. The contact arms are held against the stops by springs. These are light, just enough to cause the arm to return should they be lifted by an oversize piece. This will insure minimum wear. The gage is fastened to the base by means of two angle-pieces. To indicate electrical contact a flash bulb and battery are provided. The battery can be concealed in a base under the gage and the bulb fitted to the base at one side of the gage. The wiring of the gage is shown.

The operation of the gage is simple. When a piece that is being tested fails to pass the contact arm *F*, the light will flash showing that the piece is oversize. Should the piece pass *F* without flashing the lamp, but makes contact with *G*, then we know that the piece is within its plus and minus limits. However, should the piece pass both contact arms, it is undersize. Enough battery voltage should be used so that it will take actual contact to light the bulb.

Use a Tomato-Can for a Small Oven

AN old tomato-can, placed upside down over the simmering burner of the gas-range, makes a good oven.

A steel lid should be placed over the blaze and a small baking-dish placed on the steel cover. The tomato-can, with the lid completely removed, is then turned over the dish and the miniature oven is complete.

Many times the housewife finds it

Economize by using this tomato-can oven for small things requiring little heat

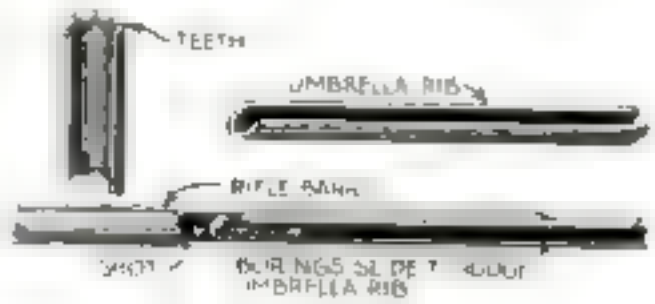
necessary to heat the entire oven for a small amount of baking. This is a waste of gas.

The small baking-oven may be used with a gasoline or coal-oil stove as well as with the gas-range. For small amounts of baking it has been found that this method is quicker, as well as cheaper. –CLEMENTINE PADDLEFORD.

Umbrella-Rib Substitutes as a Drill-Bit

THE load of shot contained in the magazine of my air-rifle became clogged a short time ago and I found it impossible to discharge or draw it. I tried drilling the lead out of the tube of the magazine, but I had no drill long enough. Another difficulty was that the lead chips would fill the space between the drill and the walls of the tube, which made it impossible to turn the drill. While looking around to find some tool that I might use for drilling out the lead, I found an old umbrella rib, one end of which was broken off. To my delight, I found that the rib, when used as a drill-bit, worked very effectively.

To improve its efficiency I filed teeth at one end and tried it again. It cut the lead shot easily and didn't bind, as the borings found an outlet through the channel of the rib. The drill may



In a case of emergency an umbrella rib may be used as a drill-rod if other drills are not long enough

be used at either end of the magazine tube. Should it cause scratches in the tube, these may be smoothed out with oil and emery-powder or with a piece of emery-cloth wound around a stick or rod fitting loosely in the tube. This tool should be drawn back and forth through the tube with a plunger-like motion in order to obtain the final smoothing. —JAMES M KANE.

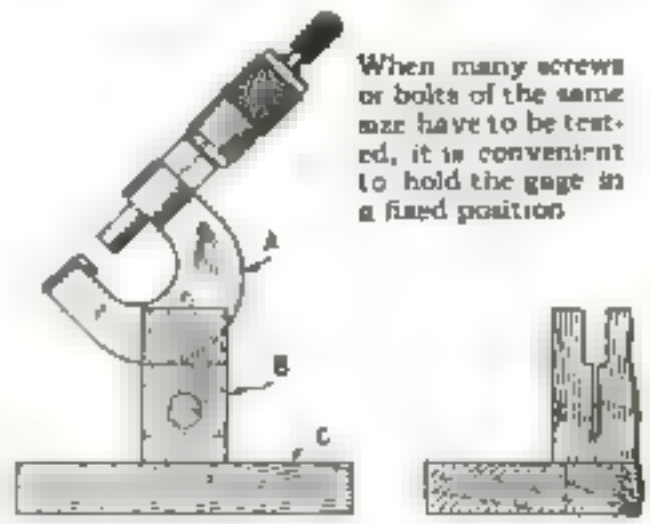
Constructing a Stand for a Micrometer

WITH all his adjustable and fixed limit gages the inspector still finds his micrometer a handy device. And there are many cases in our shop where it would not pay to make up gages, and in some cases to set adjustable gages, especially for small light work.

With this need at hand, the writer built a simple, cheap, and effective stand for micrometers as shown.

It consists of a hard maple piece (*B*) cut out to fit the micrometer (*A*) and split with a saw kerf to act as a clamp. The clamping is done with the wood screw

This hard wood piece is glued and driven snugly into an old platform



When many screws or bolts of the same size have to be tested, it is convenient to hold the gage in a fixed position

scale weight (*C*), which serves as a base to keep the whole upright. It is a very easy matter to set a pair of "mikes" in the clamp, and its handiness is beyond question.—W. BURR BENNETT.

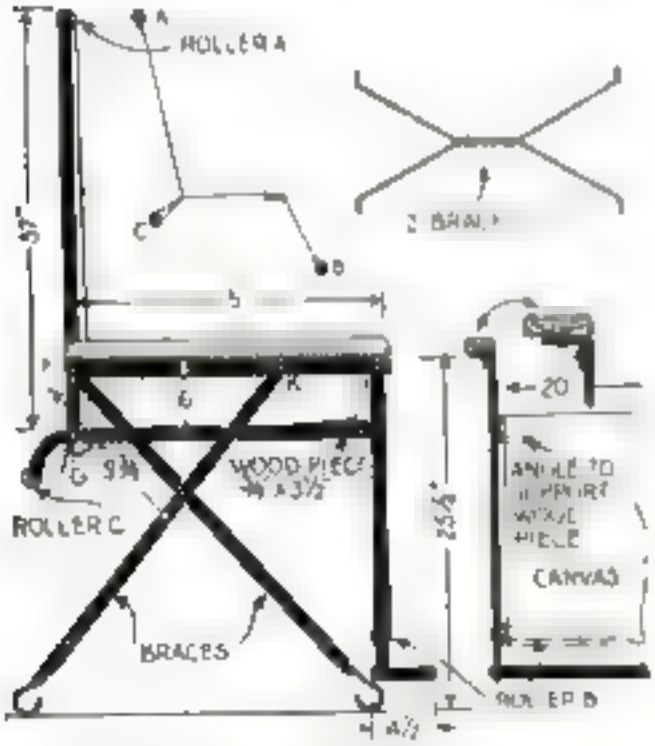
To Make a Self-Adjusting Porch Chair

By Frank W. Harth

AS a rule, the average adjustable armchair, the morris-chair, for instance, although comfortable, is at best too cumbersome and heavy to be moved very easily.

The chair shown in the accompanying illustrations is very light in weight and simple in construction. It can be taken apart and packed compactly, making it ideal for transportation to the summer camp or bungalow. The chair is adjustable to any position, this being accomplished by the occupant's moving his or her body backward or forward and by straightening or bending the lower limbs at the knees.

Reference to the illustrations will show how the chair is constructed in detail. The legs or side pieces are made of 1-in. strap iron 3 32 in. thick. The feet are made by twisting the iron in a quarter turn about 5 in. from the end and then bending it into a half circle as shown. The forward legs are a trifle longer than the rear legs. This is to provide a slight rearward tilt to the arm pieces. The two legs are then riveted as shown. The metal part of the arm piece is composed of ¾ in. by 1 ¼ in. angle-iron to which the upper ends of the legs are riveted. The armrest itself is made of wood, shaped with a round on top and then fastened



Follow this diagram and you will find how simple it is to make a porch chair

to the angle iron with flat head wood screws. The arm-rests may be of the plain wood or they may be padded and covered to suit the fancy of the maker. Those on the chair illustrated are covered with the same material as that used on the back and seat. The material in this case being canvas or awning-cloth.

The sides are duplicates, with the exception that the leg positions are reversed. The two sides are bound together by braces made of ⅝ in. by 1/16 in. strap iron, shaped and pinned together with rivets as shown. The back-rest, seat, and foot-rest are made of two iron side pieces with cross braces of wood. The iron side pieces are made of ¾ in. by 3 32 in. strap of the length shown and riveted as indicated. The rivets, which act as pivots, should be a trifle loose so that the moving parts will have free play.

The side pieces composing the seat are bent at the rear end as shown. This can be done in two ways—the

Can you imagine anything that would be more welcome on the porch in summer?

first by forging and the second by two quarter twists and a bend, as shown in the detail sketch. The distance from hole *F* to hole *G* must be exactly the same as the distance from the hole *H* to hole *J*. If these distances are unequal, the seat will not function properly and the action will be uneven and jerky.

The wooden cross pieces or rollers should be of hard straight grained wood about 1 ½ in. in diameter. These rollers are held in place by long 3 16-in. round woodhead screws. The holes in the ends of the rollers should be carefully centered and bored before the screws are put in so that the wood will not split.

The canvas back, seat, and leg-rest is in one piece, securely sewed at rollers *A* and *B*, passing over roller *C* and around the flat piece *D*, and is also very securely sewed at *E*. This stitching must be strong, as it is called upon to support almost the entire weight of the person occupying the chair.

If bolts are used instead of the rivets *F*, *H*, *J*, and *K*, the chair can be taken apart and compactly bundled for transportation.

This chair will be found surprisingly light in weight.

Mounting Double-Weight Photographic Prints

MANY times the amateur photographer wishes to mount his buff-colored photographs on cards, as it gives them a more artistic appearance than when they are left unmounted. Double-weight papers are usually made so thick that it is very difficult to make them adhere to the card without their becoming loose at the edges. Hence many amateur photographers give up the mounting in disgust and content themselves with unmounted pictures.

By using the following method, prints will stick perfectly to their card mounts and lay flat without a wrinkle.

Wet the prints thoroughly and lay them face downward on a sheet of glass. Press the water out with a roller squeegee, and turn the plate of prints on edge to drain. Then paste the center of the print, working up to within ¼ in. of the edges, putting on a reasonably thick amount of paste. Take liquid glue and put a thin coating of it on the margins of the print.

Place the print on the card, and roll with the squeegee. After this is done, take a damp sponge and wipe all of the paste off and also any glue which may exude from the edges. After the print is dry, bend the card in the reverse direction to the curl and it will stay flat. Thick ordinary starch paste spreads easier than the glue, but the latter holds the edges of the print firmer.—W. S. STANDIFORD.

A Broken Oyster-Knife Becomes a Chisel

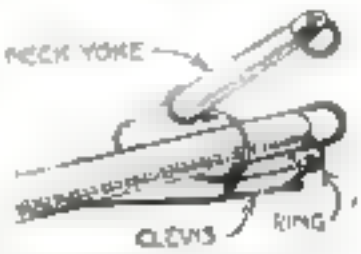
OYSTER-KNIVES are made of finely tempered steel, yet they will occasionally break, if abused beyond the breaking-point. If your oyster-knife should break as the result of too strenuous use, do not throw it away. It is too valuable to be discarded and may be made a useful addition to your set of tools. File or grind

It is plain to be seen that an oyster knife makes a practical chisel

the tapered blade at right angles, and give it a good cutting edge, taking care not to destroy the temper of the blade. This gives you a chisel that will do excellent work in cutting light metal and even stone, provided it is not too hard and gritty.—JAMES M. KANE.

To Lock the Neck-Yoke to the Tongue

TO prevent the neck-yoke from slipping off the tongue when different teams and harnesses are used, weld a ring twisted 90 degrees in the strap-iron loop at the end of the tongue. Put on the neck-yoke in the usual manner and link the lower loop to the ring with a clevis, thus holding it on



How yoke and tongue are kept together

If welding facilities are not at hand, a twisted clevis can be used just as conveniently.—J. ALEXANDER.

Causing the Electric Fan to Oscillate

By Henry A. Germain

THE accompanying sketches show the device which we applied to our stationary electric fan to get from it the effect of an oscillator. A frame of stiff iron wire was made by bending it into the form shown in the illustration. Simple hinges of strap brass were fastened to the guard of the fan at top and bottom of a vertical diameter and from these the frame was suspended. The back end of the lower hinge strap was bent down and drilled to receive the hooked end of a light spring, the other end of which engaged the loop *L* in the lower leg of the wire frame. A mass of lead, *M*, was cast around the wire, and over the frame was stretched a piece of unbleached muslin. Upon wetting it and allowing it to dry, it shrank tightly over the frame and on it an artistic member of the family painted an American flag. When the fan is running, the flag waves continuously from side to side, throwing the draft of air first one way and then the other.

The proper weight to use and its exact location along the wire, as well as the proper amount of spring tension

An electric fan is much more satisfying if it is of the oscillating variety

required to keep the oscillator in unstable equilibrium so that it would swing continuously and not come to rest in either an extreme or in mid position, had to be determined by trial, by hanging on convenient weights, and gradually tightening the elastic band used as a trial spring. When the proper conditions were reached, the weights were replaced by the single mass of lead of equal weight. The lead was cast around the wire by using a small round cardboard box as a mold. The box was slotted axially, the wire inserted and the box buried in wet sand in which a small funnel-shaped depression was made, the bottom of which ended at a hole in the upper side of the box. Into this funnel the lead which had been melted in a large iron spoon over the gas-stove, was poured. The wet sand prevented the cardboard from burning through or collapsing before the lead had set.

Of course the cloth covering was not permanently stretched in place till after the lead was cast on.

Besides the advantage which an oscillator possesses over a fixed fan in covering a wider angle, thus being of benefit to a whole room rather than merely to a narrow lane directly in front of itself, it has the added advantage, which few appreciate, that an intermittent breeze is much more effective for cooling than is a steady breeze. This is due to the fact that the

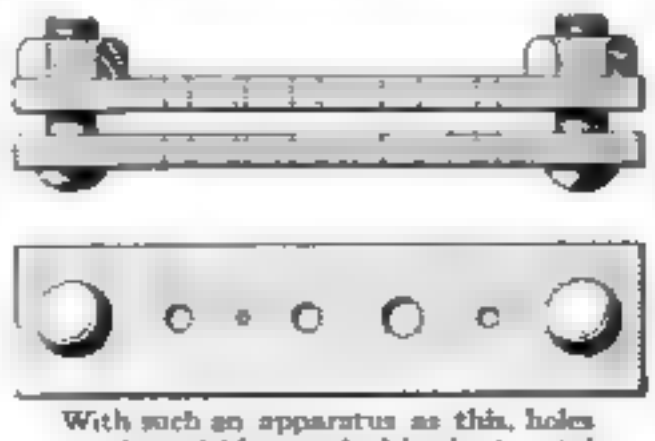
Showing the frame of wire and the method of attachment to the stationary fan

feeling of coolness which a breeze gives depends on the evaporation of moisture from the surface of the skin, the latent heat of evaporation of this moisture being supplied by the skin which consequently is cooled. Now, if a breeze blows steadily, the moisture is licked up as fast as formed, keeping the surface dry; whereas with the intermittent breeze the surface becomes moist during the intervals of stillness, with the result that when the breeze blows again, the cooling takes place much more rapidly and the effect is correspondingly more refreshing.

Placed on a shelf in the corner of a summer porch the waving flag makes a very attractive decoration, thus being ornamental as well as useful.

A Method of Punching Holes in Sheet Metal

IF it is necessary to cut a good many holes in sheet metal and time is a matter to be considered, the work can be very satisfactorily done with a punching outfit which is easily made. The dimensions will depend altogether upon the size of the sheets to be punched, but the idea is so simple



With such an apparatus as this, holes can be quickly punched in sheet metal

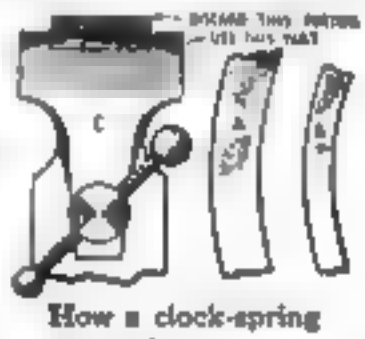
that it can readily be applied to practice.

Make a pair of guides as shown in the illustration. If there is much work to be done, it will pay to make them of tool-steel, hardened and tempered, or of mild steel and have them casehardened. Near the ends drill for two bolts. Be very particular to use accurately finished—not rough—bolts, and have them fit closely in the holes so there will be no shifting of the guides. When this has been done, bolt the guides together and drill holes of the same sizes you want to punch. The position of the holes and the number and variety will depend, of course, upon the work to be done. The holes must be smooth and true and go clear through both guides.

The punches are simply pieces of round tool-steel fitting closely, but not tightly, in the holes. The cutting ends are made square and true and hardened to a medium straw-color. To punch a hole it is necessary only to clamp the sheet metal between the guides, locating the place to be punched under the proper hole, and send the punch through with a sharp, clean blow of the hammer. A little oil makes a better job.

Making a Lock-Spring Out of a Clock-Spring

SPRINGS of alarm-clocks are as a rule not so highly tempered as to prevent them from being cut or filed This quality renders them very useful for replacing flat lock-springs that sometimes break. Should the clock-spring be too wide, it can be cut with a pair of tinner's shears, or it may be placed in a vise as shown in the accompanying illustration, allowing only so much to project above the jaws of the vise as you wish to discard



How a clock-spring was cut

The part above the jaws may be cut off with a chisel and the rough edge filed smooth.—JAMES M. KANE.

To Polish Woodwork on the Lathe

PROFESSIONAL turners and amateurs doing lathe-work in wood often find it necessary to polish turned wooden objects, like candlesticks, table legs, etc., after the lathe-work on them is completed. A very simple and highly effective method of giving to such objects a high polish in a very short time is here described.

Place the article to be polished between the faceplate and the tailstock on your lathe and use alcoholic shellac varnish mixed with one half its volume of boiled linseed oil for polishing. Shake the mixture well before using it. Pour a small quantity of the mixture on a cloth and start the lathe, hold the saturated cloth against the revolving object, keeping up the friction until the polish is as bright as you desire.

Finding New Uses for Old Things

What use have you for some of the "junk" in the attic or cellar? Popular Science Monthly will pay ninety dollars for the best answers

THERE is the old baby-carriage, the old stove, the old bureau, the trunk, and the leaky wash-boiler. The attic also contains old phonograph needles, safety-razor blades, carpets, curtains, chairs, tables, picture-frames, hat-boxes, etc. Have you been able to save money and add a convenience to your home by pressing some of these things into service again? If you have, you probably had to get the household tool-kit out to help you Sit right down now and tell Popular Science Monthly what changes you made and how you made them. It makes no difference what you changed, as long as it was old. You may win one of the prizes.

The Popular Science Monthly offers three prizes for the best answers—a first prize of $50, a second of $25 00, and a third of $15 00. These will be awarded in accordance with the rules outlined below

Rules Governing the Contest

(1) Contestants are not limited to the number of ideas, but only one method can possibly win the first prize, only one the second, and only one the third. The contest is open to everybody.

(2) The use of the old piece of junk must be shown clearly, either in a photograph or in a drawing. If a drawing is sent in, it need not be made by a skilled draftsman. It is sufficient that it should be intelligible. While pencil sketches will be considered, contestants are requested to make their drawings in ink on heavy white paper. The views should be sufficient in number to set forth the writer's idea very clearly. The contestant's name and address should appear on each sheet of drawings.

(3) The drawings or photographs must be accompanied by a description, preferably typewritten, in which the method is clearly given. It must be written on one side of the paper only, and it should not be more than 500 words in length. The name and address of the contestant should appear in the upper left-hand corner of the first sheet of the written description.

(4) The drawings and description entered by contestants must be received by the Popular Science Monthly not later than 5 p. m., on June 15, 1921.

(5) The judges of the contest will be the editors of the Popular Science Monthly.

(6) The first prize of $50 will be awarded to the contestant who, in the opinion of the judges, has suggested the best use for an old piece of junk.

The second prize of $25 will be paid to the contestant who submits an idea next in merit.

The third prize of $15 will be paid to the contestant who submits an idea third in merit.

(7) The winners of the contest will be announced in the earliest possible issue of the Popular Science Monthly. A description of the ideas that win the three prizes offered will duly appear in the pages of the Popular Science Monthly, together with the names of the winners.

(8) The editors of the Popular Science Monthly shall have the right to publish meritorious manuscripts that do not win a prize. The regular space rates will be paid to the contestants who submit the manuscripts thus selected.

(9) When a contestant submits more than one idea, the description and drawing by which each is set forth must be sent as a separate unit.

(10) Manuscripts or drawings will be returned to contestants if stamps are enclosed.

(11) Send drawings and specifications to the Editor of the New Uses for Old Things Contest, Popular Science Monthly, 225 West 39th Street, New York City.

Keeping Fish Fresh for Several Days

WITHOUT ice I have kept fish fresh and full flavored for three or four days in the heat of August, and in cooler months for weeks at a time, in the box shown in the picture. Most people make the mistake of putting freshly caught fish in water until they want to eat them.

The water soaks out the flavor of the fish and also softens the food. Also fish will hardly keep twenty-four hours in water before they show taint and spoil.

The box shown in the picture is 24 in. long, 18 in. wide, by 20 in. deep. It was sunk to half its depth in the brook

Before you start on your next fishing-trip, make yourself a box like this

that flows from a spring. A wire tray is held on a shelf made with ½-in. sticks placed ½ in. apart. This shelf is 3 in. from the top of the box.

As soon as fish are caught, I dress them and wipe them dry with a clean cloth, then place them on a layer of ferns in the tray of my box. A layer of ferns over the fish also helps. Holes bored in the cover and sides, then covered with wire netting to keep out flies, allow free circulation of cool air.

For convenience, the cover of the box was hinged in place. The water flowing through the box by means of several 1-in. holes bored in the bottom and low down on the sides, always keeps the air cold and the fish will keep for days. Roofing-paper keeps the sun away F. E. BRIMMER.

Steel Wool Used as a Filler When Soldering

THERE are a thousand and one different and distinct uses for steel wool, from finishing bowling-alleys to cleaning pans. The latest, however, is in connection with soldering. Many times when a hole is too large to fill with solder, or the material for a plug is not handy, a wad of fine steel wool will furnish just exactly the right solution. Especially is this true in the mending of lead pipe, where a queer-shaped crack makes plugging almost impossible. Just fill the opening with steel wool, then run in the solder, and a perfect seal will result, for the solder changes the spongy plug into a solid.

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Imitation Movies Without a Motion-Picture Camera

AFTER the amateur photographer has tried out all the usual camera tricks and novelties, here is a little novelty that may interest him. It consists of making imitation motion-pictures. The principle of this is very simple and easy to understand. Several photographs are mounted in book form

Turn the leaves of the book rapidly with your thumb and you will get the effect of moving pictures

and the pages rapidly spun by the thumb. If the pictures show the various phases of a motion, the effect will be that the subject seems to move.

Since the number of photographs necessary is comparatively great, small sized pictures would be less expensive, in fact, the 1⅝ by 2¼ picture is fully large enough to give good results. The number of pictures may be any number from 5 or 6 up to as many as desired. The pictures should be carefully made, as it is necessary for the subject to stop for each picture. Each picture should show an advancement in motion.

Each picture shows a little progress in the motion of the person posing, in this case a girl walking

As an illustration of the principle, see the photographs of a small girl walking

The prints should be bound in book form, being pasted on paper as shown in the drawing. The book should be a little larger than the print so as to permit of the full picture's being seen. If the pictures are now rapidly thumbed, they produce the impression of motion of the subject.—PHILIP A. WALL.

Three more poses of the same girl, representing the continuation of movement

Carry Water-Color Tubes in a Block of Wood

A WORKER in water-colors found that a case made from a 2 by 4 served well for carrying his tubes of colors from one place to another. A 12-in. length of hard wood 2 in. thick and 4 in. wide was cut at an angle with a rip-saw. The sawed surfaces were smoothed with a plane and sandpaper, and the two parts fastened together by two hinges on one side and a small clasp on the other.

Holes were bored into the body of the case of a size slightly larger than

With saw and auger you may easily make a carrying box for your water color tubes from a piece of wood

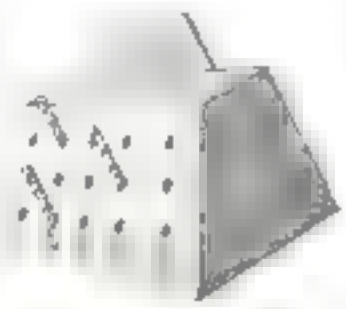
the size of the tubes. Corresponding to these holes, somewhat larger holes were bored in the cover, and the openings reamed out to prevent any difficulty in opening or closing the case.

The holes were lined with cotton flannel, glue being used to hold the lining in place, and the holes labeled with stickers, indicating the contents of each compartment.

A wire handle, fastened to the top with two brass staples, completed the carrying-case, which was then stained a suitable color.—DALE VAN HORN

Has Your Work-Bench a Drill-Stand Like This?

HERE is a simple idea and a great time-saver. Place an ordinary block of wood on the bench and drill a series of various sized holes to suit the different sized drills, marking the size under each hole.

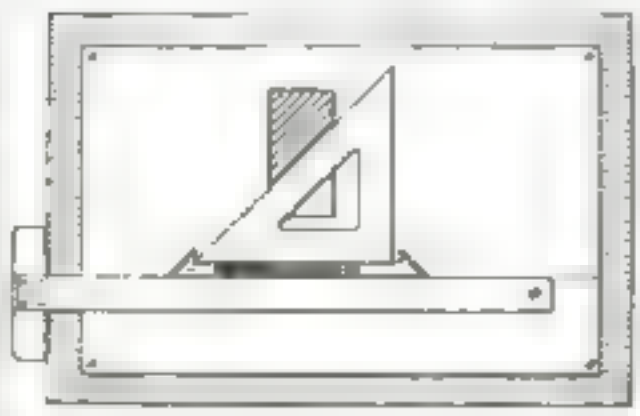


Every work-bench should be equipped with a drill-stand. Here is one easily made

At the back of the block place a board on which paste a regular tap-size table. Place your drills in the block. They must go in their proper place to fit, and whenever you desire to drill a hole for any size tap within the range of the drills in the board, all your information is right at hand.—J. H. MOORE.

Simple and Quickly Made Is This Section Liner

HAVING considerable shading and section lining to do, I desired to borrow a section ruler, but was unable to obtain one. Consequently I devised my own scheme and with a sharp knife, some heavy cardboard, glue, two 3/8-in. flat head 6/32-in. machine



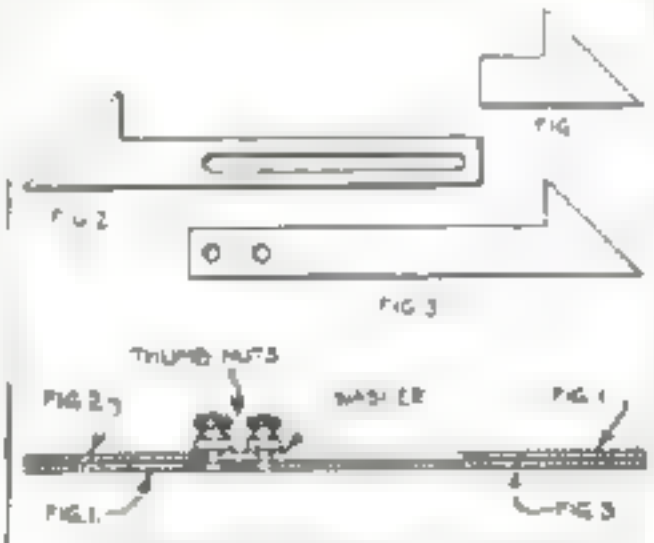
Here the section liner is shown in position for drawing lines at an angle of 45°

screws, two battery terminal thumb nuts, and two 6-32-in. washers, I made the following section liner

Cut from the cardboard two pieces like Fig. 1 and one piece each like Fig. 2 and Fig. 3. The latter two are alike with the exception of the slot and drill holes.

To the bottom of Fig. 2 glue one of the pieces like Fig. 1 and to the top of Fig. 3 glue the other

Through the holes in Fig. 3 screw the machine screws protruding through the slot in Fig. 2, and the assembly should be as shown in the cross-section. This



The parts of the device are here shown in detail, also a cross-section of the assembled liner

will give a 5- to 7-in. spread and may be used with a 5- or 6-in. 45 degree angle or a 5-, 6-, 10-, or 12-in. 60-30 degree triangle.

The method of using the section liner is shown in the first illustration, and needs little explanation. Draw a line along the triangle and then, holding the triangle stationary, slide the cardboard instrument, previously set by tightening the set screws on the instrument, to the right as far as it will go. Now hold the cardboard and slide the triangle as far as it will go and again draw the line.

This procedure is repeated until all the lines that you require are completed. - THERON P. FOOTE.

A Buckaaw Frame Made of Piping

A RIGID bucksaw frame, one that will never warp, break, or split, can be made from short lengths of common gas-pipe at little cost.

Take the measurements of the frame from an old wooden bucksaw. First, make the top bar and two short side nipples of ¾-in. pipe. The halves of the top bar are threaded at the ends, meeting in the center with right- and left-hand threads, respectively. Then they are connected by a right- and left-hand threaded coupling fitted with a pin to turn it. The side pieces are of the same sized pipe and are shaped as

A bucksaw frame made of pieces of gas pipe will never warp, break, or split

shown. The two flattened ends are split to receive the saw and each is drilled to take the bolt holding the saw-blade. Bend the long piece outward to make a handle. The middle bar is of heavier piping and acts as a brace for the frame when the blade is tightened. HORTON HALLETT

Improvise Tracing-Paper in an Emergency

IF the paper on which the tracing is to be made is soaked with a little benzine, using a cotton pad, allowing the benzine to soak into the pores of the paper, it will become so transparent that the most delicate lines and tints may be readily seen through it, more readily than through the finest tracing-paper

Water tints, India ink, and pencil can all be used on paper prepared in this way; pencil takes more readily on it than on any other paper. Any kind of opaque drawing-paper may be employed, and should be stretched over the drawing in the usual manner.

The benzine evaporates rapidly; the paper assumes its original opacity without leaving the slightest trace of the treatment to which it has been subjected. When large tracings are to be made, the benzine should be applied a little at a time, according to the progress made while working. Only a few square inches should be treated with benzine at one time.—HERMAN NEUHAUS.

Thrust-Bearing to Support Spool of Fine Wire

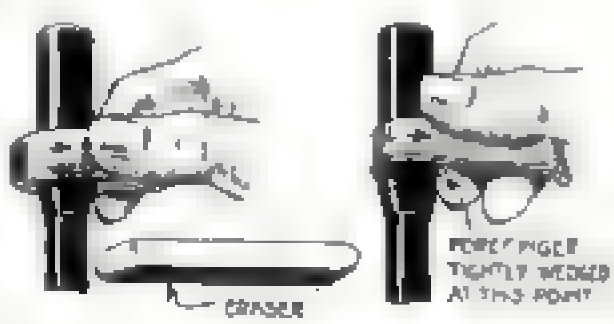
IN winding electrical appliances with fine insulated copper wire of No. 34 gage or smaller, the wire is extremely liable to break while being reeled off its spool, especially if wound at all tightly upon it, as the spool has to be rotated by the pull of the wire itself being unwound from it.

By placing a ball thrust bearing under your spool the wire will not break

To overcome this difficulty an ordinary ball thrust-bearing is placed under the spool. In the sketch the spool is shown held upright in a vise, revolving on an iron bar or piece of shafting. If there is a large center hole, a couple of wood collars may be used to center up the spool. The use of this method allows the wire to be unwound without an undue strain being put upon it as the spool rotates with little friction when supported by the thrust-bearing.

How to Loosen Tight Parts of Fountain-Pens

FOUNTAIN-PEN users frequently experience difficulty in removing the threaded or unthreaded cap when it works itself tight on the pen. The ornamental knurling is then found inadequate, and various "tools" are usually resorted to, which often have the effect of wedging the cap on still tighter and causing it to crack. The foregoing applies even more to the threaded ends of the barrel that must be removed to fill or clean.



With a rubber eraser or a heavy rubber band the resisting cap of your fountain pen can be easily removed

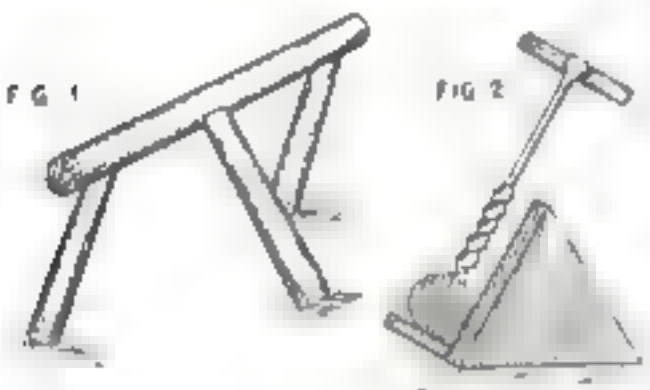
The illustration shows a simple method of readily loosening the cap. A soft rubber eraser of the type shown is held tightly around the part to be loosened, with the thumb and forefinger. This soft rubber eraser will then be found to grip the hard rubber surface perfectly, and to turn the part is then easy. A wide rubber band doubled over as shown will serve almost as well in its stead.—C. NYE.

How to Make a Three-Legged Horse or Trestle

THERE is always plenty of use for wooden horses, or trestles, on the farm, but because of the difficulties encountered in the construction of them, boxes, barrels, etc., are usually made to take their place.

The trestle shown in the accompanying figure may be easily made from saplings, with no other tools than a hand-ax and a large auger. The construction is so simple that little explanation would seem to be needed, the main difficulty being to bore the holes at the proper angle so that the legs may have the correct spread to hold the trestle steady.

If the log that forms the top of the trestle is temporarily fastened to a board, the holes for the end legs may be bored in line with each other by keeping the auger parallel with the board, as shown in Fig 2. The legs for these two holes should next be fitted and driven into place, after which the hole for the center leg may be bored by judging the angle of the auger with the



Three-legged horses like that shown here are very useful, used in pairs

legs that are already in place. Sixteen inches is about the right spread of legs for a trestle two feet high, other heights in proportion.

Of course it isn't absolutely necessary that this trestle be formed of round sticks; square ones may be used if available. A pair of light and handy horses, suitable for such work as paper-hanging, may be made from two pieces of 2 in. by 4 in. and six pieces of broom, or hoe handle. Three-legged trestles should be used in pairs; if only one trestle is required, it should be fitted with four legs.

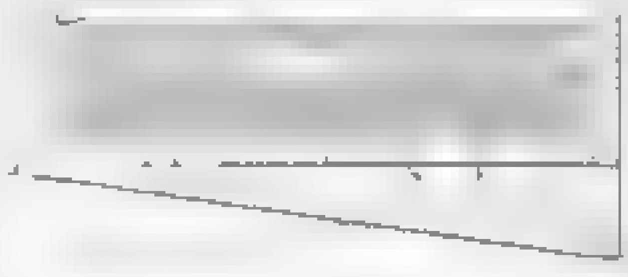
Build an Improved Starting-Box for Spring Plants

AN improved starting-box, in which tomato, cabbage, lettuce, radish and many other seeds may be started early in the spring, takes little time to build and will grow bigger and more virile plantlings.

The box shown in the illustration is of the improved type. Notice the double inclined bottom, which allows for the free circulation of air through the soil and takes care of the drainwater when the seedlings are watered. This box may be placed in the best room in the house because it will not

allow the water or soil to injure the floor or carpet.

If you have some old window-frames with glass panes, the box may be constructed to fit these, the dimensions figured accordingly. A good depth for this starting-box is 4 in., while the front side of the box is 6 in. to allow for the inclined secondary bottom under the real bottom. This box should be made 1? in. wide by 24 in. long, and

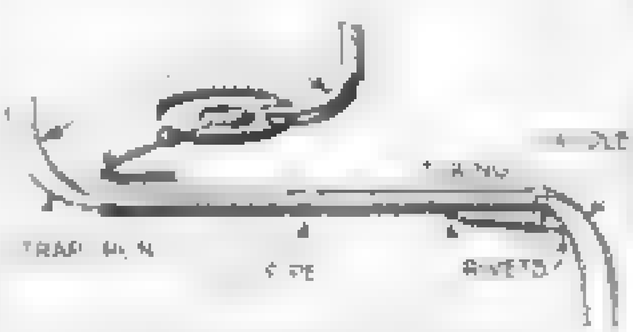


Now is the time to start the vegetables grown from seeds. Build a starting box as here described

may be separated into two or more compartments. The window-frame should be secured to the rear edge of the box by means of hinges. This box kept on a shelf in the south window will grow seedlings quickly. When well started, they should be transplanted to a transplanting box.—F. E. BRIMMER.

Here's a Tool for Placing Wild-Animal Traps

THE accompanying sketch shows a simple and efficient type of trap placer that will be appreciated by every trapper. It will be found handy for placing traps under water at rat holes, and eliminates the necessity of wading out into the water or using a boat. Its value for placing traps far back into skunk dens will also be seen. All trappers know that the fox,



The tool here shown is intended for safely placing traps under water or in places hard to reach

although sensitive to human scent, does not object to clean, odorless steel.

The sketch shows the construction. A piece of $\frac{1}{2}$-in. pipe is sawed along the center for about 6 in. and the half of each end cut off. The piece that remains can be flattened and bent. A file should be used to trim off the burrs and round the edges. The jaws and handle are made of one piece of flat strap-iron wide enough to go through the pipe without binding. The ends are bent to correspond with the pipe ends. A spring to hold the jaws open ready for action is fastened with rivets, one on the movable handle and the other on the pipe. FRANK W. HARTH.

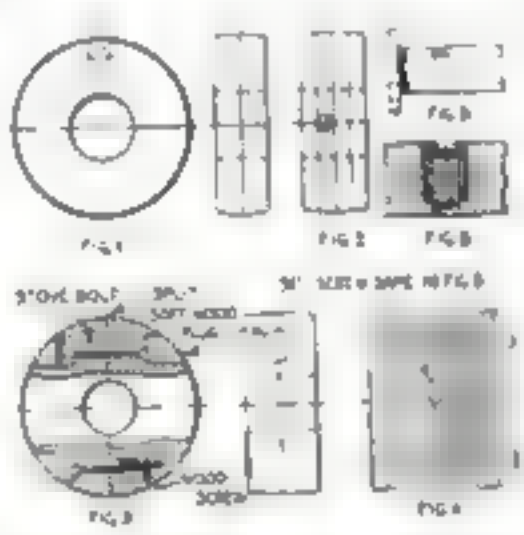
Several Suggestions for Emergency Pulleys

WHEN new machinery is installed or tests are run, a small pulley is needed in a hurry quite frequently; then begins a grand rush to locate a suitable cast-iron one, which, in ninety-nine cases out of a hundred, can not be found. As a matter of fact, if there is a lathe handy, small pulleys of any desired diameter may be extemporized of almost any materials at hand.

The simplest construction is shown in Fig. 1. This is a plain pulley turned up from a single block of hard wood, preferably maple or oak, drilled to fit the shaft, and a set screw made of an ordinary wood screw flattened at the end.

Such a pulley will give fair service for a while, but if the set screw is turned up too tight, it is liable to split the wood, though putting the screw into the end grain instead of the side will help somewhat. Then the hard wood is almost sure to check and split in time, introducing a source of danger.

A much better method is shown in Fig. 2, where a pulley is built up of



Several suggestions for making emergency pulleys are here given, all useful

several (always an even number) layers of hard wood glued together cross-grained, and strengthened by screws or nails.

Still better is the split pulley of Fig. 3. This may be clamped around any shaft without removing it from the bearings, and if bored to make a snug fit, no set screw will be necessary when the screws or stove bolts, whichever are used, are tightened up. The screw-heads may be covered with soft-wood plugs that are easily dug out if necessary to remove the screws or tighten them. Such a pulley cannot very well split while in use.

Other materials than wood (not considering cast iron or solid steel construction) may be used to advantage, such as paper, cardboard, or fiber. A pile of such disks is clamped between two metal collars, drilled for the shaft, by means of through bolts, as in Fig. 4, or a threaded sleeve, as in Fig. 5. They are then turned down to the required diameter and a set screw is fitted. Figure 8 shows how a set screw may be made to hold better in hard wood or similar material by first permanently

screwing in a larger threaded sleeve tapped for the screw. Paper, fiber, or wood faced pulleys all have a higher frictional coefficient than iron or steel.

A strong small pulley is seen in Fig 6. A hard wood hub is driven into a piece of pipe, drilled for the shaft, and the pipe turned and crowned for a pulley face. If a drive fit is made on

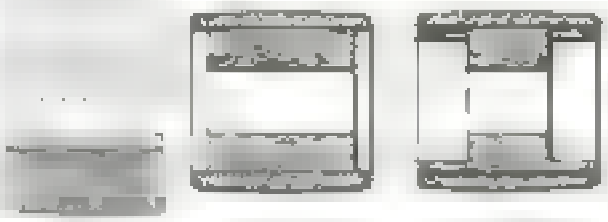


FIG. 5 FIG. 6. FIG. 7

If a particularly strong pulley is required, use one of these three types

the shaft and treated with shellac before being driven on, no set screw will be needed.

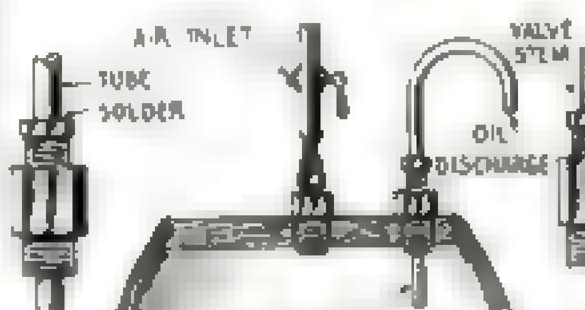
Another type is shown in Fig. 7 where a narrow wood or metal hub is driven into a pipe coupling and two pipe ends tightly screwed up against it and cut off, the face and ends then being machined

In Fig. 9 is a sleeve with flange to which any sized wood pulley may be screwed or bolted.—H. H. PARKER.

Forcing Oil from a Barrel by Air Pressure

A GOOD garage method that saves pumping oil to each customer is to use the free air pressure to force the oil into the measure by simply turning on the air-cock.

Take two old spark-plugs and remove the porcelains. Through one plug shell run a copper tube that is a snug fit and bend the top portion over in a semicircle so that it points down as shown. The long end should reach nearly to the bottom of the barrel. Solder around the plug bushing and the



When the cock of the inlet pipe is opened, the compressed air will force the oil out of the pipe

tube. Solder a valve stem in the top of the other shell as shown. Then screw the plugs into appropriate holes in the barrel head, and connect the plug with the valve stem with the air supply, placing a shut-off cock in the pipe at a convenient point.

By turning on the air-cock air is forced into the barrel, which forces the oil out of the long tube into the measure. As soon as the air is cut off, the valve-stem automatically shuts off any further pressure.—L. B. ROBBINS.

Place Protective Covers Over Small Motors

SMALL electric motors installed in dusty places, especially those used for driving grinding-wheels, should be protected by covers to keep the dirt and dust out of the bearings and windings. For a heavy-duty motor such a cover might be made of sheet iron, but air ducts would have to be provided for cooling unless the motor was of the totally inclosed variety; in such a case, an extra cover would hardly be required except perhaps to protect the bearings.

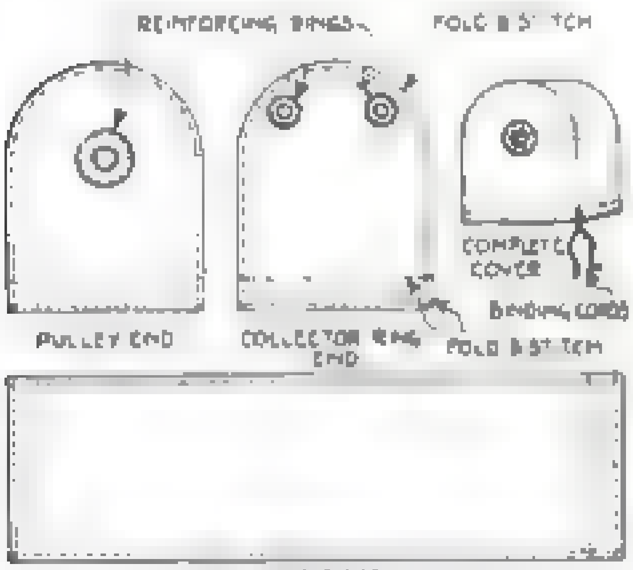
But for the ordinary small motor that is the object of this article, used for more or less intermittent service, a canvas or other cloth cover provides excellent protection from dust, while the material used is porous enough to allow some ventilation. Canvas is rather heavy, except for a good sized motor, but cheese-cloth or flour-sacking is about right.

Two end patterns and a side piece are cut out, the end pieces having a semicircular top about the same diameter as the motor housing. The edges are folded over and the cover stitched together. It should be long enough to extend below the motor base so that the edges may be bound with a cord around the base of the motor.

A good plan is to incorporate a drawing cord in the lower turned-over edge of the cover, as shown in one illustration. The hole where the shaft comes through requires to be reenforced.

The illustration above shows a ring of thin leather or felt stitched around the shaft opening for the purpose, and the ring should make a close fit around the shaft. The connecting wires may be either led in under the bottom of the cover or two reenforced holes may be put through it at any convenient point.

Provided with a cover of this kind, a small motor can be kept clean and free from dust while the bearings are well protected and enough air will be drawn through the meshes of cloth to prevent any overheating of the coils.—H. H. PARKER.



You cover your typewriter, but leave your motor exposed. Make a cloth cover for it

Wedges Used in Place of Carpenter Clamps

A FLOOR lamp was being constructed and it was necessary to have clamps at least 5 ft. 6 in. in length, and the longest clamp that was in the workshop was only 5 ft. long. Two wedges happened to be

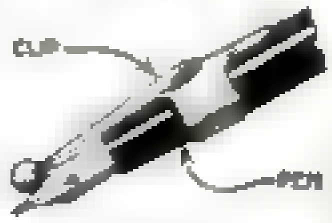
Ingenuity helped to accomplish a difficult job without a clamp of sufficient length

lying on the floor near by, so we used these wedges instead of clamps.

We placed the lamp upon the workbench and arranged it as shown in the accompanying figure. As the ceiling was very low, we wedged the lamp between the work-bench and the ceiling, and the following morning we removed the wedges and found that we had a perfect joint.—JAMES O'CONNOR.

Substituting a Pencil Clip for a Ruling-Pen

THOSE who have tried to rule lines with the help of the undercut side of a common foot-rule, know that the method is likely to result in blots upon the work. A better way is to slip a five-cent pencil clip over the end of the pen and rule the desired lines by drawing the ball of the clip along the edge of the ruler.



A pencil clip on your pen makes it a ruling pen

The clip can be used on an ordinary pen or on a fountain-pen, as shown in the illustration, but it cannot, of course, be used upon a fountain-pen having threads for a screw-cap upon the pen end of the holder.

Getting the Most Out of a Screw or Bolt

THE maximum strength that a rod, screw, or bolt will have at the point of greatest strain depends on the cross section at that point.

To illustrate—suppose we find that ½-in. bolts are required to bind two metal parts together and still have a margin of safety which will prevent any possibility of the two parts tearing loose or the sheering of the bolts. If the diameter of the bolt cross section is less than ½ in., then the margin of safety will be nil, or if there is any margin at all, it will be very small.

The accompanying illustrations show this point graphically. Figure 1 shows how the greatest strength of a bolt is obtained. The point of greatest strain in this case is the sheering point, *A*. By having the threads begin at this point, say one or two threads, the maximum cross section of the bolt will be utilized, thereby insuring maximum strength at that point for the given bolt size. Figure 2 shows by cross-section how the maximum strength of the bolt is utilized. The bolt completely fills the hole. Figure 3 shows a bolt whose threads are allowed to cross the shearing point, *A*.

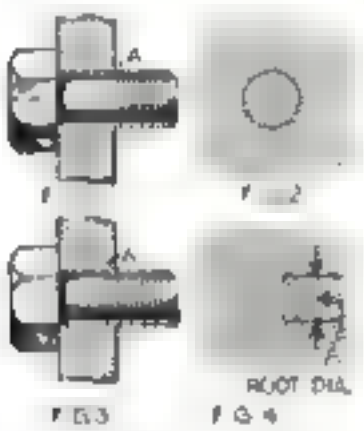


FIG 3 FIG 4

A bolt is only as strong as its thread-root diameter

The old saying, "A chain is as strong as its weakest link," may be aptly applied to the threaded bolt. A bolt is as strong as its thread-root diameter. It is plainly evident that the bolt in Fig. 4 cannot possibly be as strong as the bolt in Fig. 2.—FRANK W. HARTH

How to Mend Holes in Hard Rubber Goods

HAVING a hard rubber triangle, one side of which was broken across, I tried various ways of repairing it, but without satisfactory results, till I tried the following, which proved to be the only satisfactory cement for hard rubber that I have ever seen. It is also suitable for use on celluloid or similar compositions, or in any place where liquid glue is used, possessing the advantage over the latter that it is absolutely water-proof.

Take some scraps of celluloid—a piece of an old celluloid comb or old waste photo films (the latter being first cleaned of the gelatin layer by hot water and soda)—cut or break in small pieces, place in a wide-mouthed bottle, and just cover with glacial acetic acid (the lower grade "No. 8" acid will not do), cork the bottle tight, and set in a moderately warm place to dissolve, stirring occasionally. This may take

from one to several hours, according to the temperature and the variety of celluloid. Don't get it *too* warm, or the acid will evaporate and blow the cork out.

The solution should have the consistence of thick syrup or liquid glue. If too thick, thin with a few drops of

With a solution of celluloid shavings in glacial acetic acid, you can mend broken articles made of hard rubber or celluloid

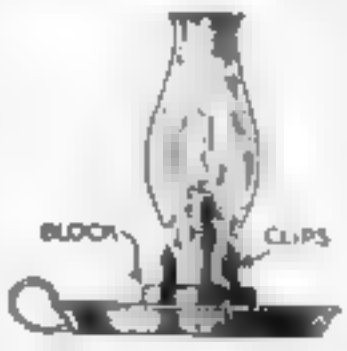
the acid; if too thin, set in a warm place, open, and allow part of the acid solvent to evaporate.

For use. Cleanse the surfaces thoroughly, and apply the cement just as you would liquid glue, using plenty. Bring parts together and clamp or bind as tight as possible. This last is important, to secure a strong repair. Let it set for twenty-four hours to become thoroughly hard. On more porous materials, where used as a waterproof glue, the time may be shortened considerably, but for hard rubber or celluloid, the full time is necessary, if you want a good strong job. When dry, scrape off the exuded surplus cement. If rightly done, the work will break anywhere else before it will break in the same place again.

Keep the cement well corked to avoid any evaporation of the acetic acid.—CHARLES A. PEASE.

Make a Protector for the Camp Candlestick

TO prevent a sudden draft from blowing out the candle make a protector as shown in the sketch. The ordinary candlestick-holder is used and the cup for holding the candle is removed and a square block of wood is substituted in the tray or pan. On each edge of the block a clip or thin piece of metal is attached with screws or nails, making four standards like those used on the regular burner of the kerosene lamp.



Just the thing for your shack or tent on rainy nights

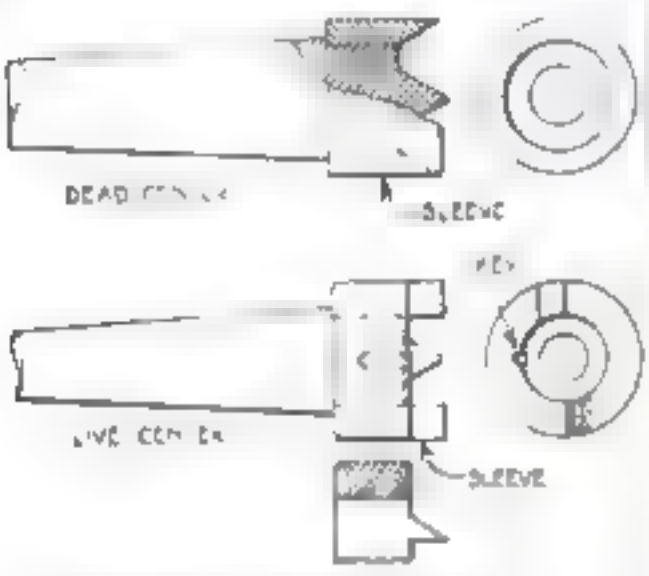
A lamp chimney is placed in the clips. For a candle-holder a hole is bored in the block, or four nails are driven into the wood around the candle. The small wax candles are used, as they are the best for this kind of a lamp.

Such a candle will burn with a steady flame.—CHARLES R. FISHER.

To Make Wood-Turning Lathe Centers

THE conventional spur-and-crotch lathe centers for wood-turning are bothersome things to make and to keep in proper shape, especially for the amateur pattern-maker and craftsman.

By making such a center in two parts, an inner tapered arbor and an outer sleeve, the construction is much easier and when worn down or damaged, as frequently happens, it may be repaired without much trouble. The dead center has a sleeve driven, but not tightly forced or shrunk, on to the arbor, so that if the point wears down the sleeve can be driven off again and a new point turned up or ground. Then the arbor is turned or ground back to a



Amateur wood-turners should equip their lathes with a live-spur center

new shoulder so that the sleeve when replaced will be in the same position, relatively, to the point as it was originally.

In the case of the live-spur center, the construction is similar, except that the outer end of the sleeve is filed down so as to form two, three, or four spurs, as desired. A solid spur center is rather difficult to make, especially as the point should run true; but by having the spurs on a separate sleeve and the point on the central arbor, this difficulty is obviated. The spur sleeve must be driven on to the arbor rather tightly, so as not to slip; or, better yet, a small hole can be drilled half in the sleeve and half in the arbor and a round key driven in for a positive drive.—H. H. PARKER.

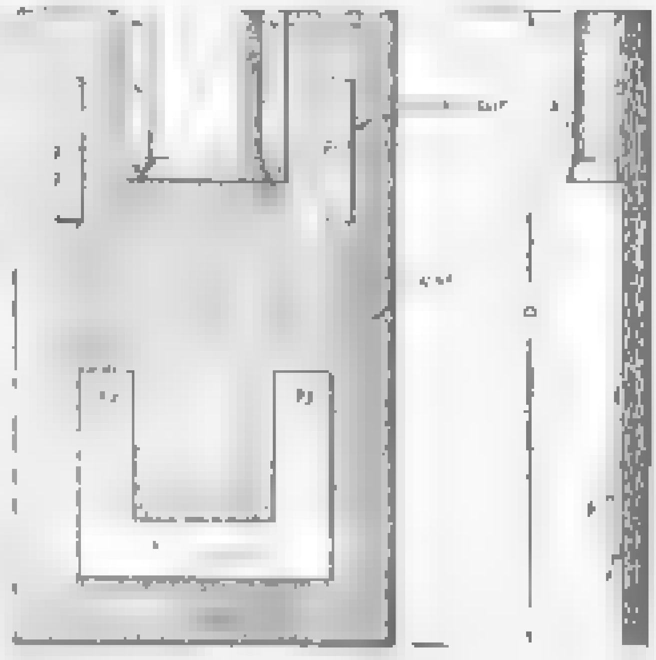
An Illuminated Writing-Board for Inspectors

METER inspectors and others who are obliged to record readings often in dark places will appreciate a convenient illuminated writing-board. It is easily made and is lighted automatically by a pocket flashlamp.

A piece of oak 10 in. by 6 in. by ¼ in. should be used for the board proper. At the center and top of the board another piece of wood is fastened to make a base for the light.

The flashlamp is bound to the board by a section of sheet brass, *A*, 1, 64 in.

thick, which is bent to form a reflector, as shown. A piece of No. 24 copper wire is soldered to the metal case of the light and run to the spring B, which is also of 1/64-in. sheet brass. Another wire is soldered to the outside post of



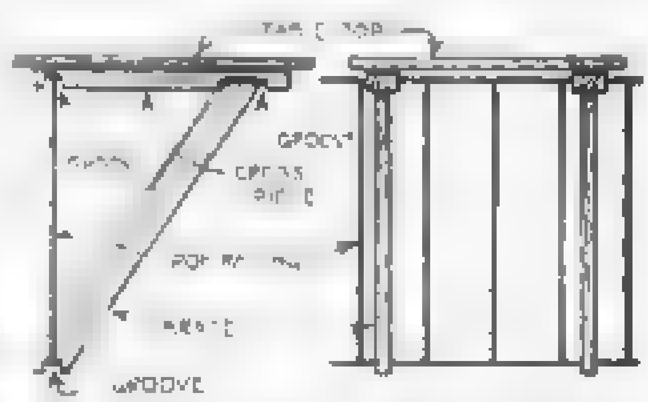
This illuminated writing-board is useful to meter inspectors and others who have to make records in dark places

the battery and run to the contact point C.

Two paper clamps (D and E) are screwed to the board to hold the writing-tablet. Now, when the tablet is pressed down by the hand, the spring B connects with the contact C, thus forming a circuit and flashing on the light.

Building a Folding Table for a Balcony Garden

THE folding table shown in the accompanying picture is so simple in construction that any amateur can make one. The top of the table is made from strips of wood taken from the side of a box, and nailed to two cross strips of 1-in. stock, 3 in. or 4 in. wide, set endwise. Notches are cut in



Beautify your balcony with flower-boxes that rest on folding bracket-supports

the cross-pieces as shown in the picture. The square groove should fit over the top rail of the fire-escape or balcony. The other groove with one slanting side receives the supporting brace, which with the notch at its lower end fits over the lower horizontal rail of the balcony.

The two supports need not be nailed to the cross-pieces of the table, but it is safer to nail them to prevent them from slipping out of the notches.

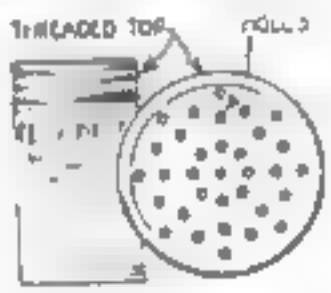
Dry Powder for Cleaning the Hands

THE powder described below will be found superior to many of the "hand-cleaners" or "mechanic's pastes" on the market, and is much cheaper.

Washing-powder, - 2 pounds
Powdered borax, - - 1 pound
Yellow corn-meal, - 1½ pounds
Oil of sassafras or citronella, a few drops

Mix thoroughly and pass twice through a sieve of about fourteen wires to the inch. This is not absolutely necessary, but is a help in breaking up the lumps. The yellow corn-meal is better than the white as it is sharper and so removes the dirt more readily. It is far superior to sand, marble-dust, etc., used in most pastes, as it does not grind the skin, but gives up some of its oil, leaving the hands much softer.

The hands should be wet before shaking the powder on them or much of it will be lost. Use a shaker made for soap-powder (costing 10 or 15 cents), but enlarge the holes with a nail. In fact, a small baking-powder can with 20 or more nail holes in the cover will do very well. If no sieve is used, put a small bolt or nut in the can as it will help to break up the lumps. If you wish to experiment, make it up in ounces instead of pounds, trying different proportions. There are several washing-powders on the market and you may have to try two or three before one just strikes your fancy. Dig your nails into the powder on your palms as you wash your hands and you will be surprised how easily they may be cleaned when your hands are dry.—ROBERT A. CHANDLER.



You will serve cleanliness and economy with this powder and shaker

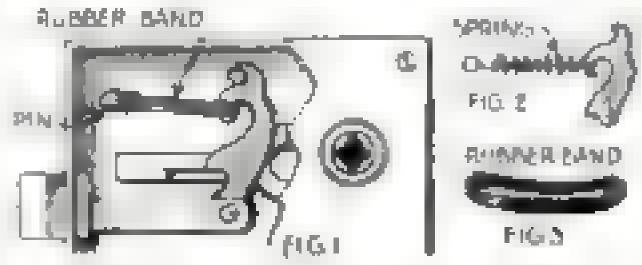
Rejuvenating a Brick Wall with Paint

FIRST of all, you must get every particle of loose stuff from the walls, which may be done with a loose fiber brush; then dust off clean. If you have enough old paint to do the job, thin it down with oil and a little benzine, strain, and apply quite thin to the wall brush this well into the surface, and let it have several days to become hard

The next coat should be a lead paint, of fresh material with raw oil and just enough driers to dry it well in a reasonable time; a little turpentine will also be of advantage. This will now give you a good foundation for whatever paint you may want to apply. E STANDIFORD.

Substituting a Rubber Band for a Lock-Spring

WHEN one of our door-locks became disabled a short time ago, because the small coil-spring on the bolt had snapped, I found myself greatly embarrassed because I could not get another coil-spring to put in place of the broken one. In this emergency I tried the experiment of substituting a rubber band for the



When the lock-spring breaks and you cannot reach a locksmith, remove the spring and substitute a rubber band

broken spring. I was highly pleased when I found that the lock could be operated as well as before.

Most of the door-locks are of very simple design and even persons who are far from being mechanical geniuses will have no difficulty in unscrewing the lock, removing the broken brass spring, replacing it by a rubber band and putting the lock back in its place.—JAMES M. KANE.

A Combination Cat- and Dog-House

THIS is an apartment-house, especially designed for two pets—Mrs. Cat occupying the upper flat, and Mr. Dog the lower.

It is a small square structure, with simple lines and painted in harmony with surrounding buildings, in two

If you have a dog and a cat, build them a house, the upper floor for the cat, the lower for the dog.

colors. An incline from a round aperture at the side leads to the upper floor. There is a running balcony for the cat, and a sleeping-shelf for the dog. A hinged roof permits cleaning.

For building this house you need the

following materials: One 16-ft. board, 1 in. by 4 in., to be cut in 3 ft. by 3 in. lengths; two 12-in. strips, 1 in. by 2 in., for the frame. Two 12-ft. boards, 1 in. by 6 in., to be cut for flooring, balcony, and shelves. Six 12-ft. strips of 6-in. lap siding. Five 12-ft. strips, 4 in. by 1 in., for roofing One 12-ft. board, 12 in. by 1 in., for rafters and incline, and several short pieces of 1-in. stock for the upper siding, two or three hinges and screws, prepared roofing 4 ft. by 4 ft., paint, and nails.

To a frame made up of 4 in. by 2 in. uprights and 2 in. by 1 in. crosspieces, the upper siding or frieze containing the balcony window, is nailed. Then the two flooring boards, at the top and side of the incline, are fastened in place. To these the incline with its inside wall is hung. With the first three boards of the lower siding in place, ledges for the shelf are put in.

The roof, made up of 4 in. by 1 in. fastened to curved rafters, is covered with canvas or prepared roofing

Make Your Own Briquettes to Save Coal

USERS of coal invariably accumulate at the bottom of their coalbins a considerable quantity of coaldust mixed with small particles of coal

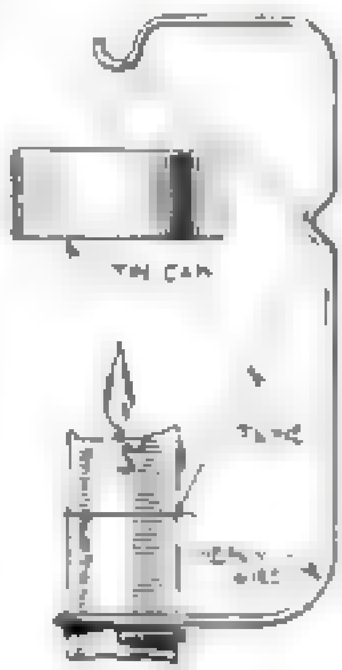
From coaldust, sawdust, and a suitable binder you can easily make briquettes that give fully as much heat as coal

chipped off from the larger pieces. This mass is too fine to be used in the furnace or stove, as it will drop through the grate and, unburned, become mixed with the ashes. This means a complete loss of the heating power represented by this coaldust.

If you have a considerable quantity of this fine coal in your bin, do not throw it away, but make briquettes that can be used in the furnace with a considerable saving of coal. Mix three parts of the coaldust thoroughly with one part of sawdust, and make a dough or paste by using some binder, like glue, asphalt, or tar. Make the briquettes by molding the plastic mass in a small flower-pot and allowing the conical briquettes to dry in the air. They soon become hard enough to bear handling without breaking to pieces. When burning, they give out good heat and burn a long time.

A Simple and Automatic Candle-Extinguisher

A SIMPLE arrangement by means of which a candle may be made to extinguish itself within a given time is shown in the illustration. A support of stout wire is twisted around the candle; this is bent in a semicircle a little more than halfway up and it finally ends in a loop. The bottom half of a small can is cut to act as the extinguisher. A piece of thin twine is pushed through the center of the can and tied with a knot. The thread is carried over the hook in the support through the curved part, finally being tied around the candle.



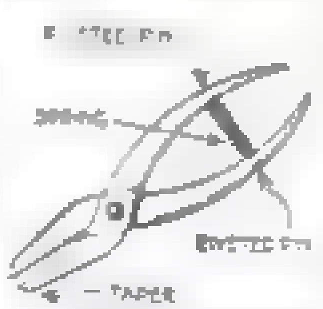
When the candle burns the string, the can-cover extinguishes the light

To set the automatic extinguisher is an easy matter. Roughly an average candle will burn half an inch in an hour. Suppose it is desired to have the candle extinguished in one hour, and the candle burns down half an inch in that period. It is necessary simply to tie the twine half an inch below the top of the candle. When the wax has been burned away to this point, down comes the extinguisher. S. LEONARD BASTIN.

Make Your Plain Pliers into Spring-Opening Pliers

IN work requiring the use of pliers it is sometimes a help to attach a spring to the handles in such a way as to hold them open except when closed by the pressure of the hand.

A good way to attach such a spring is to drill holes through the handles and insert a couple of close-fitting pins about ½ in. long. The pins may be secured in place by means of solder and the outer projecting ends should be filed down flush with the handles. A coiled spring to fit over the pins may be made of spring brass wire. In the present case, the pliers were made of pressed steel handles which could be easily drilled.

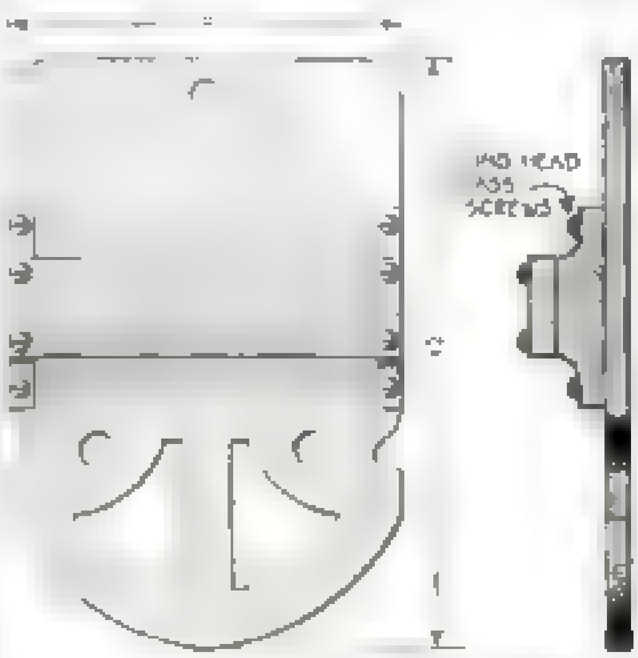


Any pliers may become spring-opening pliers by following directions

The amateur will find it possible to form seams in sheet metal with a pair of such spring pliers if the points of the jaws are filed or ground into a V shape.—C. H. PATTERSON.

Decorate the Whisk-Broom Holder with Fretwork

A NEAT whisk-broom holder can be made from ½-in. material. A discarded wooden bedstead would furnish ample material for its construction. Cut a piece 8 in. by 12 in. and carefully mark the design you intend to follow. Place it in a vise and saw out the pattern you have drawn,



A suggestion for a whisk-broom holder. With a fret-saw you can cut the design in less than one hour

being careful to cut a hair's breadth outside the lines. Rub this small margin off with sandpaper, to the line. The edges will then be perfectly smooth. The brackets used are 1 in. wide at the center and ½ in. wide at the ends. Their length is 4 in. and their thickness ½ in. Fasten them to the wall piece by means of four round-headed, brass screws. The face piece is 2 in. by 4 in. It is also screwed in place. Bore a hole for each screw before inserting it.

As to finish, white enamel would be best if old lumber is used, while stain and varnish could be used on new stuff.

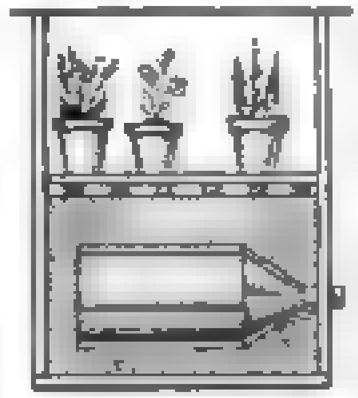
It Is Easy to Construct an Indoor Miniature Hothouse

OF great interest to the indoor gardener is the miniature hothouse. In this it is possible to keep on growing plants throughout the winter. By following the plan indicated, there is no need to have any bother with lamps or fire.

In the first place a large wooden box should be secured. This might measure about 3 ft. square or any suitable size. It is now needful to get an oil- or paint-can, or anything of a similar nature. This should be of such a size that it will fit in the box when it is lying down. Get a quantity of sawdust or sand and place a layer of this a few inches deep on the bottom of the box. Now put the can on this and bore a hole in the side of the box just large enough to take the mouth of the can. Before finally settling the can into position, it is not a bad idea to paint it inside and out to prevent rust. The inside painting is accomplished

by pouring a little paint into the can and turning it about until the interior is well coated.

Settle the can into place on the sand or sawdust, and then proceed to bury it with the material. Go on putting in the stuff until the box is about half full. Then put a number of strips of wood running both ways across the top of the material. These should be cut so that they fit tightly inside the box. A sheet of glass and a close fitting stopper for the can complete the miniature hothouse.



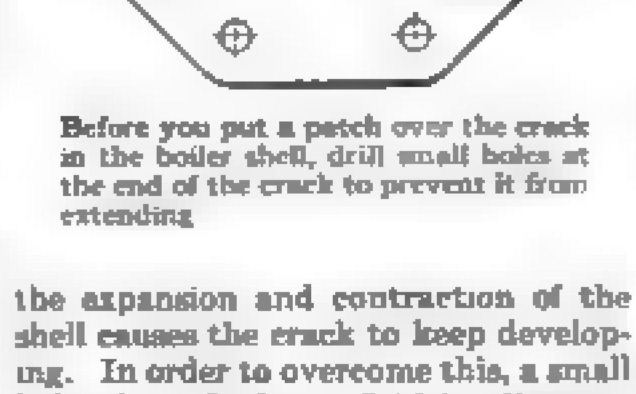
The hothouse is heated by a can of hot water covered with sand

The model hothouse is worked in this way. Turn the box up on its side and then fill the can with boiling water. Put in the stopper and let the box down again. The plants to be grown are then placed on the strips of wood. The sand or sawdust should be kept in a moist state. It will be found that the can will continue to radiate sufficient heat for at least twenty-four hours. Thus the only thing needful is to empty and re-fill the can once a day. It is not much trouble to take out the plants and return them again to their place.

S. LEONARD BASTIN.

How Boiler Cracks Can Be Checked

WHEN circumferential or longitudinal cracks develop in the shell of a boiler, the usual method is to apply a patch giving the proper factor of safety and consider the job finished. It has been found in some cases that

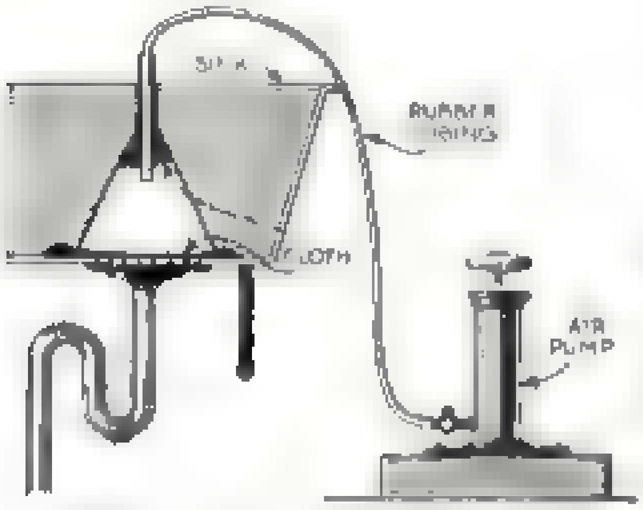


Before you put a patch over the crack in the boiler shell, drill small holes at the end of the crack to prevent it from extending

the expansion and contraction of the shell causes the crack to keep developing. In order to overcome this, a small hole about ⅜ in. or 7/16 in. diameter should be drilled at each end of the crack. The circumferential surface tends to overcome the development of the crack to a greater length. It serves the same purpose as a fillet placed in the corner of machine parts to prevent cracks from developing.

Clearing the Drain with an Air-Pump

UNFORTUNATELY it was on a Saturday evening that the drainpipe in our kitchen sink became clogged. To obtain the services of a plumber at that time was practically out of the question. In this emergency I had to assume the rôle of the plumber and help myself. The illustration shows how I succeeded in clearing the siphon part of the drainpipe by the combined use of a small funnel, a bicycle pump, and a few rags. I drew the rubber tube of the force pump through the funnel stem and packed a rag tightly between the tube and the funnel. Then I inverted the funnel over the opening of the sink drain,



With a funnel, a rubber tube, and a bicycle pump it is possible to clear the obstructed drainpipe

placing a packing of rags under the rim of the funnel and holding it firmly down, while my assistant operated the handle of the bicycle pump. Soon the pressure was strong enough to expel the obstruction in the drainpipe.—JAMES M. KANE.

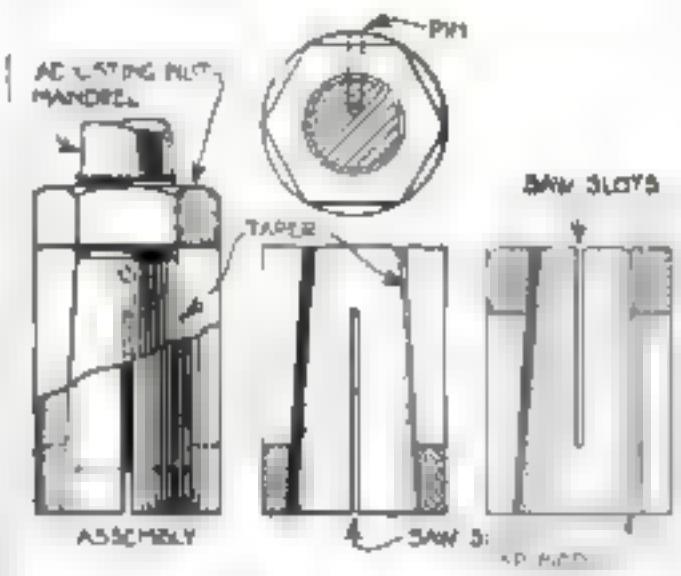
Gold and Silver Retrieved from Solutions

IF you are working with electroplating solutions, it is of importance to recover all the gold and silver in order to avoid unnecessary waste. This process can best be accomplished when cyanides have been employed, by procuring a large porcelain casserole, and boiling the solution with sodium stannate until a black precipitate comes down. Filter the precipitate and wash it with water. Add more sodium stannate to the filtrate and boil again. If a precipitate is observed, add it to the first by pouring it through the filter.

Wash the collected precipitate once more and dissolve it in aqua regia. Evaporate to dryness. Make a solution of Rochelle salts in distilled water; add it to the chlorides and heat to 80 degrees C. The gold solution will have a precipitate colored yellow brown at this point, and the silver solution will be black. These are gold and silver respectively, in a state of extremely fine division, and should be carefully washed and dried before being put away for future use.—HERMAN NEUHAUS.

Expanding Lap Diminishes Shop Costs

THE renewal of cast-iron laps in a machine-shop will be required far less often when an expanding type is used. The type shown in the illustration will save at least three fourths of the number required. In making them



Expanding laps of this type are an economy in all metal working shops because they do not wear out quickly

the only additional expense is caused by the longitudinal cuts for expansion.

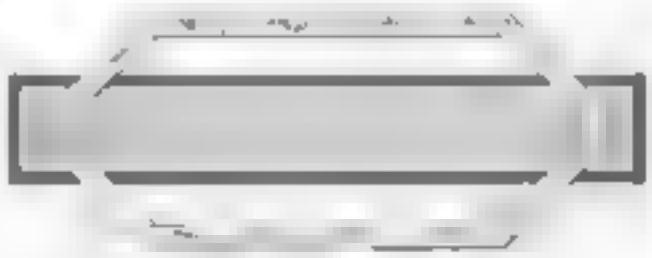
The parts involved in this type are the same in number as in any cast-iron lap—the arbor or mandrel, the nut for securing, and the body of the lap.

In the details shown, a tapering mandrel is used. This is fitted into a corresponding tapering hole in the body of the lap. With the lengthwise cuts made in the lap and alternately sawed from opposite ends, considerable expansion is obtained by screwing the nut up as is required to compensate for wear. A small drive-fit dowel-pin holds the lap body from turning on the mandrel when the adjusting nut is turned down.—G. A. LUBBS.

How to Find the Angle of a Tapered Key

MANY times it becomes necessary to make a new key to take the place of one that has become worn or defective through use.

If the key, as frequently is the case, is intended for a tapered keyway, it



The hinged gage will enable you to measure the angle of a tapered key with accuracy and speed

becomes necessary to ascertain the angle of its taper. This can easily be done by using a template gage in the manner shown in the illustration; the gage is inserted in the keyway and the angle of the taper is ascertained by taking the smallest and largest measurements.—J. R. MINTER.

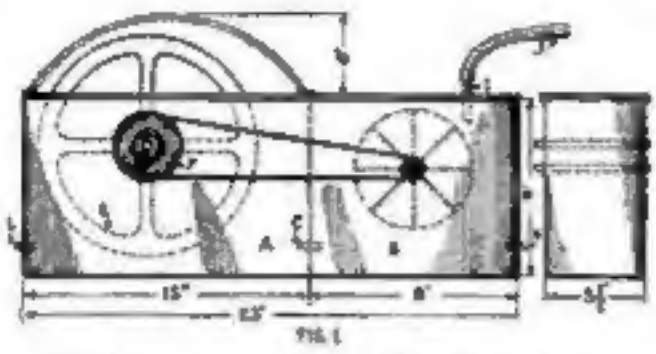
This One

CYZT-UDH-NWTR

Make a Water-Driven Machine to Develop Photographs

By H. A. Beachboard

IF you want to make an efficient and economical machine for developing and washing photographs, first procure a quantity of sheet brass about 1/16 in. thick, 13 in. of ¼-in. brass rod, also 18 ft 6 in. of ⅛-in. brass rod, 6 in. ½-in. O.D. brass tubing, 12 in. ⅝-in. O. D. brass tubing, one 4-in. grooved pulley, and one 2-in. pulley.



Water-power drives this developing and washing machine and causes the film spool to rotate in the developer or washing water

To construct the machine take a sheet of brass 23½ by 41 in. and lay out two lines across the brass exactly 9 in. from each end, also two lines lengthwise 9 in. from each edge. Cut out with tinner's snips the 8 in. by 9 in. piece of metal at each corner, as shown at *A*, Fig. 2. This leaves ½ in. on each side of end piece for soldering.

Six in. from each end drill a ⅝-in. hole. Drill two 9/32 in. holes in each side piece, two at points 4 in. from end, and 3½ in. from top, also two at points 7½ in. from end and 1½ in. from top. Bend on dotted lines and solder. Solder in a ¼-in. brass tube 4 in. long in each end.

Cut a piece of the metal 6⅜ in. by 18 in., as in *B*, Fig. 2. In the center and 3½ in. from end, drill a ⅝-in. hole. Solder a 2-in. length of ¾-in. brass tube in this hole. Bend to a right angle on the heavy line and on the dotted lines ½ in. from edges. Solder this in the tank as shown in Fig. 1. The 8-in. arm covering the water-wheel is to be soldered tight later on. See that all seams are water tight. Paint the interior with acid-proof varnish and put away to dry.

Now lay out two circular pieces 6 in. in diameter and two 14 in. in diameter. Drill a ¼-in. hole through the center of each. The two large disks may be cut out like Fig. 3 *A*, leaving a rim 1 in. wide. Lay out a circle 13½ in. in diameter on the large disks. On these lines solder 42 brass rods ⅛ by 5⅝ in. 1 in. apart.

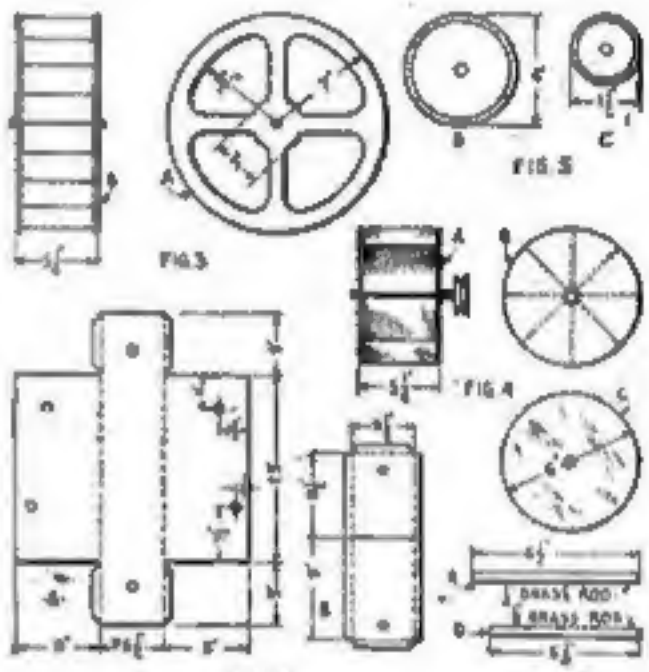
Cut four pieces of metal 5½ in. by 6 in., bend in center to an angle of 45 degrees. These are soldered in place between the two 6-in. disks, care being taken to get the edges spaced equidistant around the circumference, forming 8 pockets in the water-wheel. Place the wheels in the tank, using the two ¼-in. by 6½-in. rods as shafts to which the wheels are soldered. See that ¼ in. of each shaft extends in front through the bearings to which the two pulleys are attached.

Drill a ⅜-in. hole and solder in the ½-in. tube in the exact center 2 in. from the edge. Then solder the cover on the tank. Figure 4 shows a cover over the film reel. This is not necessary. Connect the two pulleys *F* and *G*.

For developing, fasten the film to the reel *E* with pins. Close the outlets *L* and *C* with rubber stoppers and pour in enough developer to fill the tank *A* to a depth of 3 in. Connect the intake *I* with the water-faucet by the rubber tube *J*. See that the outlet *K* is open, then turn on the water.

For fixing, the procedure is the same.

In washing, close the outlet *K*, open *L* and *C*, and the water serves the double purpose of driving the motor and washing the films.



Details of construction and dimensions for a developing and washing machine

Suggestions of Simple Jigs for Special Work

By H. H. Parker

THOUGH not intended for precision or repetition work, the jigs shown in the illustrations are useful for special work where a number of holes a certain distance apart have to be drilled. In Fig. 1, for instance, a series of holes equally spaced are to be drilled along the edge of a plate.

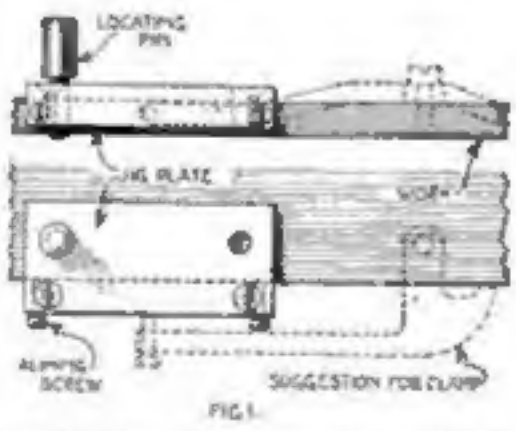
The jig consists of two plates screwed together with two holes drilled; locating bushings or plain holes may be used according to requirements. A locating pin is made to fit snugly into the holes.

To use the jig, it is clamped against the work and the first hole drilled; the locating pin inserted and the second hole drilled; the jig moved along one hole, the pin inserted again, and so on.

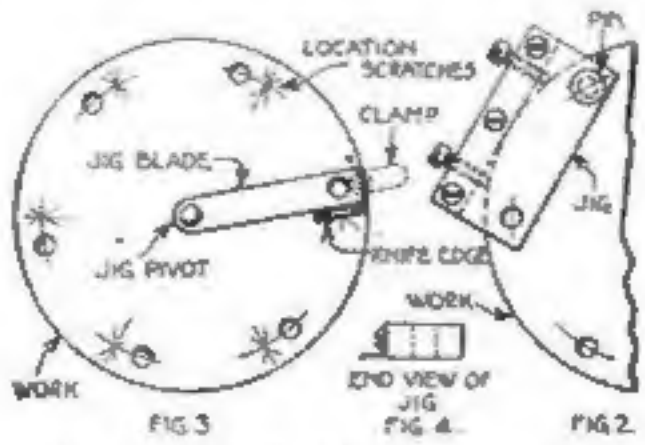
Two alining screws are shown, which at times might be of assistance in properly lining up the jig. They should fit tightly into the holes tapped for them or else be provided with locknuts.

If a very large number of holes is to be drilled along the edge of the plate, a clamp might be provided to hold the jig against the work after the first three holes are drilled, as suggested by the dotted lines of the plan view and elevation of Fig. 1.

Figure 2 shows the same type of jig



Special jigs are extremely useful for certain work, like drilling equidistant holes along straight or curved edges. This jig is for straight-edge work



For spacing drill holes along the edge of a disk, the form of jig shown is used

applied to a curved edge; here the two alining screws are necessary.

Figure 3 illustrates a pivoted jig for drilling holes around the edge of a disk, the points being first spaced off as accurately as possible with the dividers. The scratch marks are not at the locations of the actual holes as drilled, but serve to locate the jig, which is provided with a knife-edge angle-plate screwed to one edge as shown. This knife edge is brought carefully to the intersecting scratches, the jig clamped, the hole drilled, and then the jig is moved along to the next set of scratch marks and the process repeated.

This will generally result in a more accurate job than drilling out a series of center punch marks, for it is very difficult to drill exactly into the center of a small punch mark, but if the jig is set exactly at the mark and there is no play between the drill and the hole in the jig, or in the pivot hole, the hole must go through in pretty nearly the correct location.

The writer, who has had considerable shop experience, has found these jigs extremely useful in a variety of operations and strongly recommends their use.

A Grinding Attachment for a Small Lathe

By Arthman Capron

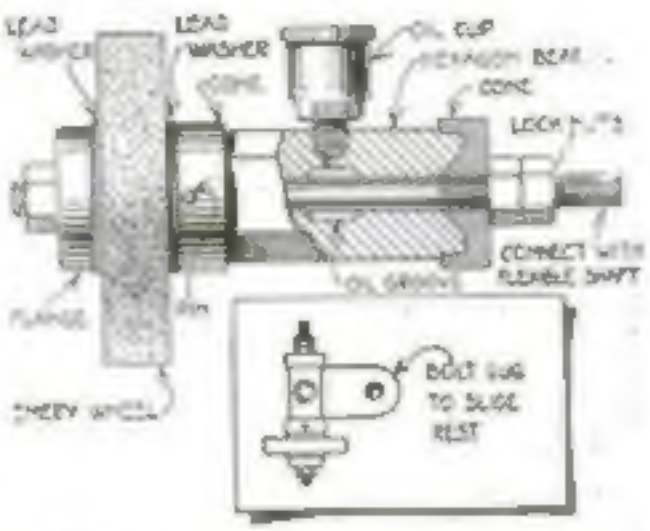
OF the many small attachments that I have contrived for my lathe perhaps there is none that has given me more satisfaction than a grinding-head I made, to fit the slide-rest of my lathe.

It consists of a piece of hexagonal brass rod about 1 in. in diameter and 2 in. long. This was drilled for ¼ in. clear through. A cone was bored on each end, recessed ⅛ in. from the ends, at an included angle of 90 degrees or 45 degrees from center line.

I used a center drill and countersink combined and drilled both ends of the hexagonal brass rod in the lathe. Then the ¼-in. hole was drilled clear through. About midway in the rod a recess about ⅛ in. deep and ⅜ in. wide was bored to form an oil-chamber. The ends (outside surface) were turned down until a perfect cylinder was formed.

I then procured some 1½-in. steel rod and made 2 cones, each with a sleeve to fit over the cylindrical ends of the hexagonal rod. These cones must be made very carefully. Next I procured six steel rods ¼ in. in diameter. Both ends were threaded and 2 in. of unthreaded portion left as a bearing. One cone was threaded on and a hole bored through it for a pin to lock it to the shaft. The pin must be placed sufficiently far from the end, so as to leave space for 2 lead washers, a flange ⅛ in. thick, made of iron, the same diameter as the cone, and a lock-nut or preferably 2 lock-nuts.

It was necessary to mount the bearing on the slide-rest and find its height, so that the center of the shaft coincided with the center of the lathe. Next I made a piece of metal strap so shaped that, when it was fastened to the top of the slide-rest by means of the T-slot, the bearing was in alinement with the centers. It is best to make this strap the same width as the bearing, minus the width of the flanges on the cones. The bearing can then be fastened to the strap by screws. A hole was drilled and tapped for a grease-cup, to reach the oil-chamber from above the strap. The other cone was then fastened on by tapping, to fit



The grinding attachment is fastened to the slide-rest of the lathe and is driven by a flexible shaft

the shaft and a lock-nut was screwed home. The end of the shafting was then cut until only ½ in. protruded from the lock-nut.

The next problem was the flexible shaft to drive this attachment. I made a small brass ferule, threaded internally the same as the shaft, and got some closely coiled door-springs (such as are used to keep screen-doors shut). One end was tinned ¼ in., sweated into the end of the ferule and the center filled with a piece of round lamp-wick soaked in a mixture of oil and graphite.

This was attached to another piece until the proper length was obtained to attach to the source of power. Then some flexible metal gas-tubing was obtained, long enough to go over the whole flexible shaft. Clamps were fixed at the ends, one for the bearing and the other for the source of power. This was filled with oil and graphite and the shaft was then threaded through.

The end of flexible shaft was sweated to a piece of brass rod and a tube to fit over this rod was fastened to the end of the gas tubing. This kept the grease from leaking out and gave a good appearance to the job. The shaft should run at quite a high speed, at least 1500 r. p. m. In my case it is driven by my induction motor, through an extension on the shaft, the lathe being operated through a reduction gear.

The proper speed for the lathe would depend on the size of the article being surfaced. In any case, the grinder should run in the opposite direction to the lathe, and the work in the lathe should revolve rather slowly.

It will be noticed that the tendency of the oil in the bearing to fly off against the work has been overcome by making a sleeve on the cone to work outside the bearing.

In my case it gives entire satisfaction, especially on such jobs as shaftings or cylinders, pistons, etc. With a medium carborundum wheel at a high speed, a polished surface is obtained directly from the first cut and the work can be guaranteed accurate, but great care must be used in feeding the wheel against the work, as there is no spring in a grinding-tool.

Designing on Asphalt-Covered Glass

AN old idea expressed in a new way is incorporated in the accompanying pictures. In its essential details it consists of an asphalt-covered glass plate and a photograph.

Any glass plate of convenient size can be taken and, after thoroughly cleaning to remove all dirt and dust, one side is carefully covered with a rather thick layer of asphaltum. To do this successfully, hold the plate in the left hand with thumb and forefinger, pour a small quantity of liquid asphaltum on the plate and gently dip it from side to side. Continue to add asphaltum until the entire plate is evenly covered. Now lay it on a level surface. If some asphaltum runs over the edges, leave it until dry, when it can easily be scratched off.

When the asphaltum is dry, draw a design on it with white ink; scrollwork or fancy floral designs are very effective. With a needle scratch the outline of the design on the glass, then, with a sharp knife, remove all of the asphaltum between the lines.

Now place tinfoil over the design and glue it to the asphaltum. The more the tinfoil is crinkled before it is glued, the greater will be its effectiveness. Place the photograph in the space provided, and cover the entire back, *i. e.*, the asphaltum side, with thin cardboard or stiff paper, and frame if desired.

Instead of using crinkled tinfoil to fill in the designs, colored paper or celluloid may be used. Attractive photograph-frames and card-trays may be made in this manner.

Amateurs are here shown a new way for giving expression to their artistic ability for decorative work

Crinkled tinfoil forms an attractive background for the scrolls on the asphalt-covered glass

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